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THE REPORT OF THE INTERNATIONAL CONFERENCE ON ELECTRICAL UNITS AND STANDARDS, 1908.

The report of the International Conference of Government Delegates on Electrical Units and Standards, held in London last October, has lately been issued in the time-honored blue-paper cover that denotes the British official document. It is a remarkable document from various standpoints. In the first place, it is brief and easily comprehended. It is also translated into French and into German, evidently by qualified translators and not by a scribe. There are nine articles and a preamble in the resolutions, signed by the delegates. The preamble recites the customary adherence to the c.g.s. electromagnetic fundamental units, the decimal derivatives of which are the ohm, ampere, volt and watt. It is then declared, in effect, that the international ohm, ampere and volt are to be recommended as a concrete set of units representing the c.g.s. derivatives. The international ohm, prepared according to a certain specification, is the first primary unit. The international ampere defined by an electrolytic measurement, following another specification, is the second primary unit. The international volt is defined in terms of the international ohm and international ampere.

The above resolutions invert the order of units adopted by the first International Electrical Congresses, which made the volt second and the ampere third. The new plan purports a realizable precision of 1 part among 100,000 in both the international ohm and the international ampere, whereas the inference to be drawn from the appended schedule for preparing Weston normal cells is that a precision of only 1 part among 10,000 is thereby obtainable. However, the advantage of the new resolutions is that they are definite and eliminate inconsistency in the concrete primary standards. This is a more important consideration, from an international standpoint, than the question of the relative precision realizable. The watt is defined correctly enough as "the unit of power," a decimal derivative of the c.g.s. unit of power; whereas, by an unfortunate choice of language, the international watt is inaccurately defined as "the energy expended per second" by 1 amp under a volt. This makes a watt appear to be a unit of *energy*. A more precise definition would have been, "the international watt is the *power* expended" by an ampere under a volt, or *the rate* of expending energy measurable in units of energy per second. The same inaccuracy appears in the French translation, but the German translation avoids the inaccuracy, and states the matter correctly.

Perhaps the most important work of the conference, as set forth in its resolutions, is in its recognition of the fact that, in order to maintain the highest degree of conformity between the concrete units defined and subscribed to, it becomes desirable to establish an international electrical laboratory, to be equipped independently of any national electrical laboratory and admin-

istered under international inspection. A permanent international commission for this purpose is recommended to be established by the various Governments. Pending the appointment of a permament international commission, the president, Lord Rayleigh, was urged to nominate an international committee of 15 "to formulate a plan for and to direct such work as may be necessary in connection with the maintenance of standards, fixing of values, intercomparison of standards, and to complete the work of the conference." This committee of 15 has been nominated. It enlists two Frenchmen, two Englishmen, two Germans, two Americans, one Belgian, one Russian, one Italian, one Austrian, one Dutchman, one Swiss and one Japanese. It is further proposed to consider whether the work of the new international commission may be incorporated with the existing International Commission of Weights and Measures, at Sèvres, in France. It would certainly seem very fitting that the international laboratory which now maintains and dispenses the international meter and gramme should also maintain and dispense to national laboratories the international ohm, ampere and volt. If this plan can be brought into successful operation, the international conference of 1908 will have achieved an epoch-making advance in international electrical accomplishment. There will be one world laboratory, under joint national operation, for the maintenance of a common system of concrete standards.

Synchronous Commutators.

If we consider the action of an ordinary synchronous converter in a substation, steadily at work converting alternating currents into direct currents, we may observe: (1) that the machine automatically maintains a set of polyphase alternating voltages between the segments of the commutator, and (2) that it also maintains a synchronous rotation of the commutator with respect to the brushes, whereby the said polyphase e.m.f. system delivers a constant direct-current e.m.f. between the brushes. The above essential conditions of operation in a synchronous converter have led electrical engineers to aim at simplifying the machine by developing the required polyphase e.m.f. system in a stationary transformer structure, and supplying this polyphase e.m.f. to a simple commutator, with a little synchronous motor to maintain the required synchronous relative motion between the commutator and its brushes. In particular, Hutin and Leblanc developed at Paris, in 1892, a machine called a "panchahuteur" consisting of a polyphase stationary transformer, having its secondary windings connected to the segments of a stationary commutator, the brushes of which were rotated by a small synchronous motor, and delivered direct current. The same machine was found to be capable of converting direct currents into alternating currents, either single-phase or polyphase; and the name panchahuteur, a slang term for a circus clown, was suggested for the machine by an electrical engineer who witnessed the range and flexibility of its behavior.

In France the panchahuteur has been in limited industrial service for a number of years. In this country practice has always adhered to the rotary converter. The advocates of the pure rotary commutator have claimed that the rotation of the armature structure in the converter, in order to secure the polyphase e.m.f. system, resembled the alleged old Chinese custom of burning down the inhabited pigsty each time that roast pig was desired. But it must be borne in mind that the converter possesses certain advantages by way of reliability not inherent in a simple rotating commutator—namely, that if the frequency varies within ordinary working limits powerful magnetic forces are automatically evoked tending to keep the commutator in step; whereas, in the rotating commutator, if the little synchronous motor does not keep the brushes on the proper segments, violent sparking may be expected. In other words, the advocates of the converter have always laid stress on the reliability of the machine, both in starting and in sudden emergencies.. The article by Messrs. J. B. Whitehead and L. O. Grondahl, on page 914, describes in detail the performance of a 5-kw experimental rotating commutator. The description, taken in conjunction with the oscillographs, presents many interesting features.

Operating Producer-Gas Plants.

While the number of small central stations operating on producer gas in this country is yet very limited, the results obtained in existing gas plants so far indicate that the gas producer and gas engine will play an important part in the operation of small central stations in future without regard to the outcome of producer gas in large plants. The anthracite gas producer, when properly taken care of, seems to be giving excellent results in several small central stations. In such stations the poor economy of a steam plant operating under similar conditions makes it possible to use expensive anthracite coal and still show a saving over the operation of a steam plant, unless the steam plant is operated very near to the soft-coal mines.

Unreliability has been the principal drawback to the producer plant. To judge from the experiences of central stations which are operating successfully with small anthracite producers, the greatest difficulty to be overcome in starting a new plant is the general lack of experience of both owners and operators with producer plants. It has come to be a matter of common knowledge that the gas engine alone, aside from the producer, is a machine which requires an entirely different kind of knowledge for its operation than does a steam engine. There are not enough gas engines in use to render it easy to pick up experienced gas-engine operators. Frequently steam engineers or machinists have to be trained for the service and the company operating the gas-engine plant has to pay for their education and experience—many times in the form of annoying interruptions to service. But when the operators are thoroughly familiar with the gas engine it is a perfectly reliable piece of apparatus, unless possessed of some inherent mechanical defect due to bad design or material.

When we come to gas-engine and producer operation, together, conditions are 10 times worse than with the engine alone as regards lack of experience of owners and operators. The producer is an entirely new piece of apparatus to most central-station operators. In the suction producer, which is the one commonly used in small plants, the gas is made from moment to moment by the engine as it draws air through the firebed in the producer. In this respect it is radically different from a steam engine drawing its supply of steam from a boiler, as the boiler has considerable steam-storage capacity, and the fires

under it can be manipulated with great freedom without causing a shutdown of the engine. In the case of the gas producer, on the other hand, the quality of the gas is dependent upon a rather exact manipulation of the fires, moisture supply and air supply. After the proper routine has been thoroughly acquired and the attendant has learned to detect immediately indications of faulty gas supply in the engine and to apply the remedy promptly at the producer, the operation of the producer plant becomes simple and reliable; but until the operator has reached that point it is likely to be anything but reliable. The initial symptoms of different kinds of troubles must be thoroughly learned by the operators, all of which takes time. The lesson to be drawn from all this is that it is best not to depend on starting up a producer plant for giving regular service until the operating force has been trained to the new apparatus.

Educational Shams.

This is the age of physical, mental and spiritual breakfast foods, of substitutes and just-as-goods. We stand firmly for popular education, for liberal opportunity for learning, and straightforward democracy in educational institutions, but we believe in calling things by their right names, and in that intellectual honesty which is the foundation of science. Therefore, when there appears a tendency, however well intentioned, in education, that means putting a premium on the superficial and lowering the already too low existing standards, we feel moved to protest. A bill is now under discussion in the ancient Commonwealth of Massachusetts which, if carried through, will do more to demoralize genuine education than anything yet seriously proposed. In brief, the plan is as follows: Any town or city which is willing to lend space in its school buildings is to have established in it through the medium of tutors and peripatetic professors borrowed from other institutions, a full-fledged "college" with the power of granting degrees of learning. It is figured that by this device the goods can be delivered at the cost of about $134 for the four years' course. By this means, too, the students have the opportunity of living at home and of securing work, if necessary, while pursuing their studies, and the "aristocratic ideals" of the ordinary college designed for the "privileged few" would be eliminated. It is only fair to state that the remarkable institution, with its so-called "distributive centers," is to have a genuine endowment, and has the support of a certain number of "educators," mostly of the kind rampant in the public schools.

In effect, the ambitious high-school principal would be able to add a "college" to his plant and to go through the solemn farce of playing university by the aid of the kind of college professor who can find time to travel about the country giving lectures. The "tutors" presumably would be selected from local talent. If the present school plants are to be thus used, it is sufficiently obvious that the college work would in the main have to be done in the evening. Evening schools are no new thing, and are, of course, capable of doing well when properly administered, but they put the pupils at a material disadvantage from taking them after a day's work. The advocates of the proposed institution seem to be a-quiver with sympathy for the poor student who now has no chance at the alleged aristocratic college, and propose to give him a near-education as an annex to his public school art, nature study and music—things now thrust upon him, on the ground that he has no spiritualizing influences in the home. It is sheer nonsense, in view of actual history, to assume such an attitude, and it is well-nigh insulting to the student of small means. The alumni lists of all the American colleges are rich in the names of honored and distinguished men who have had to make their own way in the world—who have walked, if need be, from their native farms to the nearest college town, settled down to the grim work of earning their way unaided, and have won out. No mollycoddles these, whining about lack of opportunity and the college for "the privileged few," waiting apathetically for the peripatetic culture, but the stern stuff of which a nation's greatness is built. There are hundreds of them in the colleges to-day, and they will be heard from later. They are a power for good in the life of the college as they have always been, because they mean business, and theirs is the "college spirit" that the promoters of the present makeshift denounce as an aristocratic idea imported from England.

Massachusetts has already a round dozen of higher institutions of learning. If any more are really needed, the old Commonwealth must be in a bad way. The most seriously objectionable feature of the present proposal is that, with utterly insufficient equipment, it proposes to give the semblance and the name of a college education while necessarily unable to give its substance. To come to particulars, how would the laboratory courses fare, and what kind of instruction could be expected in them? The present promoters ask now merely the privilege of granting the A.B. and A.M. degrees, but when the poor, dear student wants to enrich his course with science and professional studies, the demand for the B.S., D.Sc., LL.B., M.D., E.E. and other degrees will be too strong to resist. And evidently with several great institutions granting a degree for a three years' course, that, too, will have to follow, and we shall have the edifying spectacle of 50 high schools, with their meager equipment and overworked teachers, grinding out professional degrees with none to say them nay, save the promulgators of this unique scheme, whose wisdom and respect for thorough scholarship are sufficiently in evidence already. It would seem that with the high schools and their auxiliary private institutions, the excellent classes of the Y. M. C. A. and similar bodies, enough opportunity now exists below the college grade, except as there is a need for the thorough and genuine trade and commercial school. If the promoters of get-culture-quick methods would turn their attention to these neglected matters there might be opportunity for doing something really effective, provided they were capable of the thoroughness which is demanded in so serious a task. Good practical schools of this class are important in function, but all too few. For every college and university, using these terms in their better sense, there are needed half a dozen of these eminently useful institutions, and their foundation would be a great public benefit. There are already, in fact, more alleged colleges and universities than are necessary efficiently to serve the community. If endowments for higher learning are available, they can do better work by providing equipment and scholarship in existing institutions than by adding to the number still more of inferior grade. Intensive rather than extensive work is the need of American education. From the kindergarten up, the superficial has been too much at a premium. Let us have no more but less of it.

Senate Increases the Duty on Arc Light Carbons.

The tariff bill reported this week by Senator Aldrich, chairman of the Senate Finance Committee, makes notable increases in the duty on arc light carbons, not only over the rate in the Payne bill, but also over the present Dinley rates. The Dingley bill changed the former duty of 30 per cent ad valorem to $9 per 1000 carbons. This rate was fixed in conference, and it was charged that a rate of duty higher than intended by Congress was surreptitiously substituted in the bill while in conference, the discovery not having been made until after its passage. The Payne bill fixes the duty at 35 per cent ad valorem, which is a decrease on all grades of carbons except those for flaming-arc and searchlight lamps. In these cases the ad valorem rate increases the duty on flaming-arc lamp carbons about 50 per cent, and on searchlight carbons as much as 2000 per cent. The Aldrich bill imposes a duty of $7 *per 1000 ft.* on arc-light carbons, and the increase of the tax follows from the custom of importing carbons in long lengths. Flaming-arc lamp carbons, for example, are usually imported in lengths of 600 mm, or about 2 ft., and consequently the Aldrich measure will increase the tax on these from $9 to $14 per 1000, or about 55 per cent. Enclosed arc-lamp carbons are imported in lengths as long as 28½ in. The increase in tax on these will therefore be from $9 to $16.59 per 1000, or about 66 per cent.

It is stated that the arc-light carbons imported form less than 15 per cent of the total consumption. Few flaming-arc lamp carbons are made in this country, and carbons imported for enclosed arc lamps are only those of a special quality not manufactured here. On several occasions German workmen have been brought over to make carbons of the latter quality, but without success, either through want of proper materials, or lack of incentive to persevere, owing to the situation of the arc-carbon industry. The inferiority of street lighting in the United States as compared with Germany has been ascribed to the relative cheapness of good carbons in the latter country. Should this be correct, the practically prohibitive rate of the Aldrich bill will increase the handicap, besides lowering the revenue from this source and without creating a situation tending to lead to any improvement in the manufacture of domestic carbons.

Preliminary National Electric Light Association Program.

The program for the National Electric Light Convention, to be held at Atlantic City, June 1-4, has been as far as practicable so arranged that members interested only in a particular subject may not be obliged to be present during the entire convention. In order to be able to cover most effectively the large variety range of subjects to be considered at the meeting there will be simultaneous sessions on the third and fourth days.

The program for the two sessions of Tuesday is necessarily somewhat miscellaneous in character, including the usual addresses, some reports of committees and several papers. A feature of this day will be an illustrated lecture by Mr. Paul Bauder on "Quality of Light." The morning of Wednesday will be occupied by a "manufacturers session," at which papers relating to new apparatus will be presented, with the condition that the authors of such papers shall confine them to information not previously published. The afternoon of Wednesday will be devoted to an executive session and the public will not be admitted.

Simultaneous sessions on Thursday will deal respectively with technical and business subjects. Under the first-mentioned head there are 14 papers covering as many subjects. At the business sessions, commercial and managerial questions will be considered. On Friday there will be simultaneous sessions for the consideration respectively of questions relating to accounting and to a miscellaneous program including the relation of the isolated plant to the central station, advertising, domestic uses of electricity and the electric vehicle. The program as here printed is subject to additions and to changes as to distribution of papers. Following are the titles of the reports and papers to be presented:

Tuesday.

"Report of Committee on Uniform Accounting," by H. M. Edwards, chairman; "Report of Committee on Progress," by Mr. T. C. Martin; "Report of Committee on State and Company Branches," by Mr. R. M. Searle, chairman; "Report of Committee on Meters," by Mr. Geo. Ross Green, chairman; "Private Policy," by Mr. Paul Lupke; "Latest Developments in Street and Park Lighting," by Mr. J. W. Cowles.

Wednesday—Manufacturers' Session.

"Advance Information Regarding Developments in Storage Batteries," by Mr. Jos. Appleton; "Advance Information on New Types of Arc Lamps," by Mr. A. J. Mitchell; "The Status of the Arc Light," by Mr. N. R. Birge; "Recent Types of Arc Lamps and Their Operation," by Mr. C. E. Stephens; "Methods of Manufacture of Incandescent Lamps, Carbon, Metallized, Tantalum and Tungsten Lamps, Showing by Samples Various Processes," by Mr. J. E. Randall; "Some Recent Developments in Electrical Apparatus," by Mr. E. W. Allen; "Distributing Transformers," by Mr. E. G. Reed; "Future Requirements of Central-Station Companies," by Mr. P. Torchio.

Thursday—Technical Program.

"Report of Committee on Gas Engines," by Mr. J. B. Klumpp, chairman; "Report of Committee on Grounding Secondaries," by W. H. Blood, Jr., chairman; "Report of Committee on Protection from Lightning and Other Static Disturbances," by Mr. B. E. Morrow, chairman; "Report of Committee on Overhead Line Construction," by Mr. Paul Spencer, chairman; "Condenser, Cooling Towers and Auxiliaries," by Mr. M. R. Bump; "Reactances in Connection with Turbo-Generators," by Mr. P. Junkersfeld; "Unique Features in Power-Plant Design," by Mr. G. L. Knight; "All-Day Efficiency Tests on Station Transforming Apparatus," by Mr. S. M. Farmer.

Thursday—Commercial Program.

"Methods of Introducing Tungsten Lamps and Their Effect on Central Station Income," Mr. W. H. Atkins, editor; "Practical Illuminating Engineering in the Commercial Department," Mr. G. A. Sawin, editor; "Cost of Obtaining New Business," illustrated with curves, Mr. R. M. Searle, editor; "Can a Display Room Be Conducted Upon a Profitable Basis?" Mr. Frank B. Rae, Jr., editor; "Advantages to Be Derived from Uniform Comercial Department Forms and Methods," Mr. C. N. Stannard, editor; "Compilation of Load Factors," Mr. E. W. Lloyd, editor; "Power," Mr. H. J. Gille, editor; "The Advantage of Group-Drive in Certain Installations," Mr. C. A. Graves, editor; "New York High-Pressure Fire System," "Development of Revenue from Existing Customers," Mr. T. I. Jones, editor; "Electrical Heat for Industrial Purposes," Mr. Charles J. Russell, editor.

Friday—Miscellaneous Program.

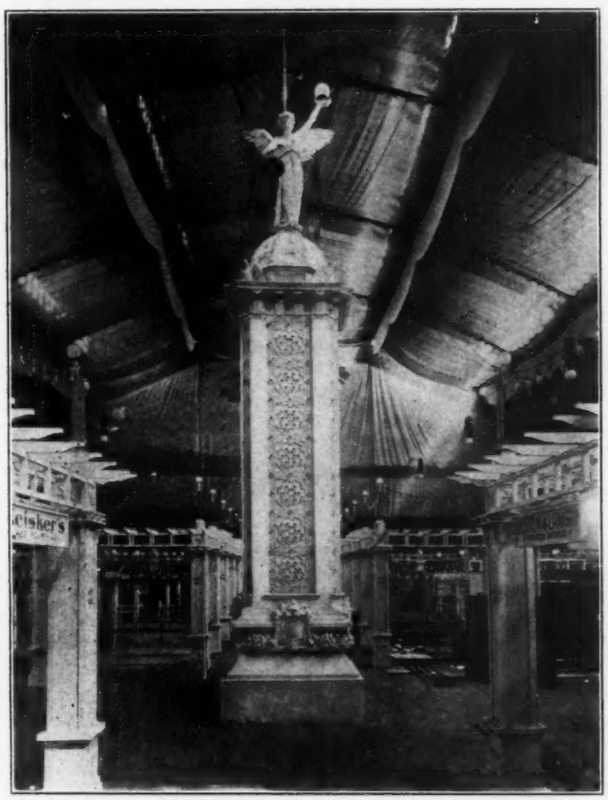
"Electricity for National Advertising," by Mr. George Williams; "Isolated Plants—Lighting, Power, Arguments Successfully Used, Experience of Various Companies," Mr. R. S. Orr, editor; "Central Station Operation of Steam Plants in Connection with Lighting Company's Service," S. Morgan Bushnell, editor; "Novel Methods of Advertising in Small Towns," Mr. Alex. J. Campbell, editor; "Electricity for Domestic Purposes—Installation, Domestic Appliances," Mr. M. E. Turner, editor; "Effect of Various Conditions of Maintenance on the Efficiency of Illumination," Mr. A. L. Eustice, editor; "Relation of Electric Vehicles to Central-Station Business," Hayden Eames, editor.

Friday—Accounting Program.

"Depreciation," by Mr. G. E. Claflin; "Payrolls," by Mr. W. W. Freeman; "Cost Accounting," by Mr. A. V. R. Coe; "Supplies," by Mr. E. A. Baily; "Branch Offices," by Mr. E. J. Allegaert.

Louisville Electrical Show.

On Monday evening President Taft touched a button at the White House which started the machinery in the Southern Electrical Exposition at Louisville. Though many exhibitors were late in their preparations, all had their space filled by the opening day. The electrical exhibits are principally from the Middle West, but States as far east as New York are fairly represented. That many manufacturers were late in awakening to the opportunity was indicated by applications for space equal in amount to that already allotted, received after the lists had been closed. The affair was designed as an industrial as well as an electrical exposition, and a certain amount of space had been assigned to Louisville manufacturers in general lines; if, however, the electrical concerns had made their applications earlier, the management might have made the show an all-electrical affair. In the main the makers of electrical appliances for



VIEW OF CENTRAL ROTUNDA BEFORE EXPOSITION WAS OPENED.

home lighting and labor saving contented themselves with representation in the large exhibits of the two Louisville lighting and power companies which act as their agents in the Louisville territory. Lamps and large power appliances of nearly all the well-known makes were well represented, as were the electrical publications. The exhibits of the *Electrical World, The Engineering Record* and the *Electric Railway Journal* are in a good location at the intersection of the two principal aisles, and the booths attracted favorable attention by reason of the taste displayed in their decoration.

The two exhibits which most excited the public interest were the "handless" electric clock, described in these columns last week, and the Marconi wireless outfit. The latter is not connected at present for actual demonstration, but the incidental lectures of the men in charge and the "dummy" illustrations of the method of sending and receiving, keep the space in front of the exhibit crowded at all hours.

The general illumination scheme was based on artistic ideas, with an absence of any straining for novelties and fanciful effects; neither was there any attempt at impressing the public by mere profusion or massing of light. Some idea of the success which rewarded the efforts of Mr. G. Wilbur Hubley, of the Louisville Lighting Company, who acted as director of power, and Messrs. Lewis S. Streng and B. F. Allen, of the Kentucky Electric Company, director and vice-director of illumination, may be had by reference to the illumination on the "Falls City" picture. The picture is a gigantic panorama, done in oil, of New Albany and Jeffersonville—Louisville's two largest suburbs. The canvas covers the entire north wall of the Exposition main hall—about 7000 sq. ft.—and no special lighting is provided, the nearest lamps being those on the girders of the roof and about the exhibits on the floor; nevertheless, every detail of the big picture stands out at its proper value and is visible from any part of the huge main hall, no glare or "shine appearing on any portion of it."

Virtually all the interior lighting is accomplished with frosted incandescents of various types and sizes, there being only a moderate but judicious use of flaming arcs. Down each aisle and around each booth are two lines of festooned frosted incandescents, the first line 10 ft. above the main floor and level with the ceilings of the booths, and the second 15 ft. above the floor and strung along the capitals of the ornamental pillars at the corner of the booths, the pillars being 16 ft. apart. Sixteen-cp incandescents are used for these festoons at intervals of 12 in. Higher up are lamps surmounting the peaks of the various superstructures and mounted on "link" staves on top of the pillars; other lines follow the balconies, while on the roof girders are 32-cp incandescents and flaming arcs. Within the booths the exhibitors were allowed a reasonable latitude in their illuminations, but all excesses in the way of quantity calculated to mar the general effect were forbidden. All booths are ceiled over, an arrangement which gave the exhibitors a reasonable opportunity for display; nevertheless, the directors found it necessary to curtail some of the plans brought forward by lessees of space. Those who grumbled at this were better satisfied when they saw the results brought out by the test illumination.

The exposition current is furnished by the Louisville Lighting Company and the Kentucky Electric Company, each taking care of half the total consumption and each providing a "breakdown" equipment to take care of the whole in case of accident to one or the other. The consumption by the Exposition, including a "white way" approach for two blocks along Walnut Street to the Exposition, is estimated at 65,000 kw-hours for the 12 working days on an estimated lighting equipment of 25,000 4-cp lamps and excluding the numerous small extra consumptions incidental to such an undertaking. The figures, considering the dimensions of the main hall of the Exposition Building, 48,000 sq. ft., give a good illustration of economy and efficiency to those who view the excellent effect obtained.

Aside from the "white way" approach to the Exposition there is extra street illumination by the city of Louisville throughout the business district and also an increase in the number and lighting duration of electric signs of merchants, which together make an increase in the total draft on the power and lighting companies almost equal to that of the Exposition proper. Something like 200 large signs were put up in the shopping district during the days immediately preceding the Exposition, besides a large number of smaller ones. Two of these affairs would as exhibits be worthy a place among the chief attractions of the Exposition proper. One of them is probably the largest changeable letter sign in the country which girdles the sides of a clothing establishment; it is 202 ft. long with 36-in. letters. The other affair, also put forth by a clothing house, is a roof sign at one of the most prominent corners in the city. It is 53 ft. long and 35 ft. high, the height of the letters ranging from 18 in. to 12 ft.

The Exposition opened financially as a success both for the management and the exhibitors. Almost from the beginning of the advertising campaign of some months orders from Southern territory, which is almost virgin ground for many lines, began increasing. The number of visitors from the far South promises to be surprisingly large.

Incandescent Lamp Exhaust Litigation.

The United States Circuit Court for the Southern District of New York has rendered a decision in a case involving a patent (No. 726,293) granted to John W. Howell, April 28, 1903, on an application filed Nov. 9, 1897, relating to the chemical exhaustion of incandescent lamps. The court states that the only difference between the patented process and that practised by Malignani is that after pumping all the air which can be conveniently removed from the bulb by the vacuum pump, the connection is closed by Howell by pinch-cock pressure, and in the other case, which is claimed to infringe the Howell patent, by fusing the glass bulb extension by heat. The court expressed doubt if the use of the pinch-cock involved invention, but not passing on this point, held that the fusing process did not infringe the Howell patent. The parties to the litigation were the General Electric Company, complainant, and the Hill-Wright Electric Company.

Chicago Train to Atlantic City Convention.

To accommodate the Western visitors to the annual convention of the National Electric Light Association, to be held in Atlantic City June 1 to 4, a special train will be run from Chicago to Atlantic City over the Pennsylvania Railroad. It will leave the Union Station at 3 p. m. on Sunday, May 30, arriving in Atlantic City about 2 p. m., May 31. This train will be dispatched as a second section of the well-known "Pennsylvania Special," the 18-hour train between Chicago and New York. An equipment equal to that of this handsomely appointed train is promised. Mr. John J. Schayer, of the Commonwealth Edison Company, 139 Adams Street, Chicago, has been appointed Western master of transportation for the convention and he will be glad to give information about the special train not only to Chicago visitors, but to all others who may find it convenient to rendezvous in Chicago and take the special. Mr. John F. Gilchrist, of Chicago, secretary of the association, is also active in the effort to assure a strong Western delegation.

New York Public Service News.

The Public Service Commission of the First District of New York has drawn up a tentative franchise for the extension of the Hudson & Manhattan Railroad under Sixth Avenue and Forty-second Street from Thirty-third Street to the Grand Central Station. The terms of this franchise were foreshadowed in our last issue. They are practically the same as those under which the present Sixth Avenue tunnel was constructed. The terms of the franchise are subject to change by the commission after the public hearing which occurs on April 13. The commission is of the opinion that this franchise is the most liberal to the city that has ever been granted. It provides that at the end of the 25-year period, which will be July 10, 1927, the city may buy the line for what it cost to construct it, this cost being determined by appraisers. The franchise is void unless the consent of the Board of Estimate is obtained within six months and unless within the same period the company is able to file with the commission the consent of the owners of one-half of the property on the streets under which the line passes. The line must be ready for operation within three years after construction work begins. The company must pay to the city $9,000 annually for the first 10 years and $15,000 for the remainder of the 25-year period as rental. It also must pay to the city for the first 10 years an annual assessment of 50 cents for each linear foot of single track and an assessment of $1 a year for the remainder of the franchise period. It also must pay to the city $500 a year for each entrance and exit to its stations. The tunnel must be constructed of steel and masonry or of iron or of any two of these materials combined. Excavations must be made without obstructing traffic and the tracks must be constructed on the most approved plan to reduce noise and tremor. The company is required to file with the Comptroller a bond of $200,000 for the faithful performance of the terms of the franchise. The franchise is perfectly satisfactory to the officials of the railroad with the exception that they feel that the annual rental of $9,000 is too high. Under the various franchises authorizing the construction of the McAdoo tunnels, the company will be paying, when this new line is completed, four of these $9,000 rentals; one for each of the two tunnels under the Hudson River, one for the Sixth Avenue line and this last one for the extension.

The Public Service Commission has granted the Interborough Rapid Transit Company until May 5 in which to equip a second experimental train with side doors for service in the subway. The side doors in the second train will be located in the center of the car, the engineers of the company having decided that the side doors in this location will be much more satisfactory and less dangerous than at the ends of the car, as was proposed by the commission's expert, Bion J. Arnold. It is pretty well understood that the commission is determined that the subway trains shall be equipped with side doors.

The Public Service Commission has received an application from the Pelham Park Railroad Company and the City Island Railroad Company for permission to issue $50,000, 5 per cent, 25-year bonds each. The purpose of these issues is to construct a monorail system railroad for passenger transportation between Bartow on the New Haven Railroad and City Island on the Sound.

Senator Travis and Assemblyman Robinson have introduced bills in the New York Legislature intended to carry out the recommendations made by the Public Service Commissions for changes in the law providing for the construction of rapid transit lines. The main features of these bills, which are identical, are that they exempt from the city debt limit the bonds that are issued for the construction of self-sustaining rapid-transit roads; they amend the existing law so that some method of constructing rapid-transit lines in outlying boroughs can be provided whereby at least a portion of the cost can be paid for by local assessment; they provide that rapid-transit lines may be built either with city money or with private capital with the title to the property either in the city or in the company; in the latter case the property will be subject to taxation. The latter provision contemplates the granting of a franchise for a fixed period with a provision that the city may at any time after 10 years become the absolute owner by making full payment for the property taken without any payment for the franchise. If the city does not buy the property after 10 years and before the expiration of the period fixed in the contract the property belongs to the city at the end of the period free and clear without any payment. While the railroad remains in the hands of the company the net profits must be divided equally between the company and the city. The present operating term of 20 years is retained in these laws with a provision for an extension of 20 years more. There is an alternative provision that independent rapid transit railroads may be constructed with city money by the lowest bidder for construction and that the city may then contract with private parties to equip and operate, but that any such contract is subject to termination after 10 years by the city making payment according to the terms fixed in the contract. The operating contract can only be made for a limited term of years and at its expiration the city must buy the equipment at an appraisal price. Under this contract, the city also gets an equal share of the net profits. Other provisions in the proposed laws permit the public service commissions to take advantage of the methods outlined in some of the recent offers that have been made for the construction and equipment of subways. The titles to these lines, however, must rest with the city at all times. Amendments also allow the construction, ownership and operation by private parties of extensions to existing lines, but such extensions must be subject to purchase by the city at any time after 10 years and must become the property of the city after a lapse of a suitable period without any payment whatever.

The lower branch of the New York Legislature has defeated by a decisive vote the bill providing for the control of telephone and telegraph companies by the Public Service Commissions.

Ice Jam at Niagara Interrupts the Electric Service.

The ice and water conditions which prevailed in the Niagara gorge last Friday and Saturday, and which still existed when this report was written, will long be remembered as remarkable and unusual. On Wednesday, April 7, a fierce gale swept the lake region and Niagara. This storm resulted in a breaking up of the ice in Lake Erie, so that tremendous quantities of it poured down the Niagara River to the falls. All day Wednesday the wind kept the ice close to the American side of the river, but on Thursday and Friday the stream carried ice on nearly every square foot of its surface. This mass plunged over the Horseshoe and American Falls, and passing down in the gorge of the river, the ice was forced up against the shores on both sides. It soon reached the guard rail of the Gorge road, and then, as the river still kept rising, the icy mass was jammed high over the tracks for miles of distance on the New York side. Poles were battered down, wires fell, and other damage was done to the gorge road property, but how much is not known at this writing. It is likely that it will take weeks, perhaps months, to make repairs. Docks, boat houses, pumping stations of private owners, as well as trap nets were carried away by the ice.

Friday night the river in the gorge reached its highest point. The ice in the gorge between the falls and Lake Ontario caused the flood to back up, and these conditions endangered the station of the Ontario Power Company at the water's edge on the Canadian side. By Saturday morning the station was out of commission and the company found it necessary to issue the following statement.

"During the night the unprecedented accumulation of ice below the falls, extending for nearly nine miles to Lewiston and beyond, caused the water to rise about 40 ft. above normal. The maximum record for high water in the past, covering a period of 70 years, is about 28 ft. above normal. The power house is designed with its windows about 7 ft. above the highest previous known height of water. Last night, however, the water exceeded this previous record by about 12 ft., and the water and ice poured through the windows and south door of the power house, at once causing a stoppage of the machinery. Temporary connection is being made, through the courtesy of the Electrical Development Company, with that company's works, and the steam reserve plants at Rochester, Syracuse, West Seneca and elsewhere are being used to supply a portion of the load in the State of New York. The intention is to supply the public-service corporations first, such as railroads and lighting companies, and afterward the manufacturers and private users.

"No permanent damage is done to the power house or its machinery. As soon as the water is pumped out of the power house it will only be necessary to clean and dry the machinery before resuming full operation. The money loss is extremely small, but the inconvenience suffered by customers is, of course, serious.

"A recurrence of the accident is impossible, as the windows will be built up solid to a height above any possible rise of water in the future, and the south door, which is not necessary to the operation of the works, will be closed with masonry."

At the same time that the water damaged the station of the Ontario Power Company it reached a height of 2 ft. above the basement floor of No. 2 station of the Niagara Falls Hydraulic Power & Manufacturing Company, but as the basement is shut off the water did not get in. The turbine and generator installation was still about 8 ft. above the water and no damage was done. This would indicate that the torrent of water that plunged over the falls was held back by the ice between the station of the Niagara Falls Hydraulic Power & Manufacturing Company and the falls, forcing it to back up into the Ontario station, as it did not flow off rapidly enough to care for the downpour over the falls. While the Ontario Power Company's steel towers were placed high above the river below the Devil's Hole, the ice reached and damaged them.

Meeting of Electric Vehicle and Central Station Association.

The regular monthly meeting of the Electric Vehicle and Central Station Association was held at the Edison Building, Boston, on April 7. The speaker was Mr. Day Baker, New England manager of the General Vehicle Company, his subject being "The Congested Streets of Boston, and a Remedy." Mr. Baker discussed the various schemes which have lately been studied by various public and semi-public organizations with the object of reducing traffic congestion, and showed that the cost of teaming tunnels runs into the millions with additional excessive operating expense. Street widening is also impracticable for financial reasons, in a city like Boston. Passenger transportation methods have progressed far in advance of those for handling merchandise in cities. The horse in the large city is the true cause of congestion, as well as a menace to health. It is estimated that the horse is responsible for an annual expense of $65,000 in the Boston Street Department alone.

Mr. Baker then reviewed the sphere of the electric vehicle and described a large number of prominent applications. When it costs a dollar a foot to house a delivery-stable equipment it pays to consider the advantage of electricity. Five times the space is needed for horse-and-wagon service as for the electrical installation. A number of cases were cited where marked economies have resulted from the superseding of the horse by electricity. Arnold, Constable & Company, of New York, save 28 per cent over horse costs and handle the work better. Electric vehicles have just doubled the routes of R. H. Macy & Company, New York, compared with horses. On account of improvements in the past few years the cost of operation of the electric vehicle has been reduced 30 per cent, with 30 per cent increase in mileage and speed. Electric vehicles occupy only half the space on the streets that is required by horse-drawn teams.

The Boston Edison Company recently placed in service a modern single-motor General Vehicle Company delivery wagon, which is used by the lamp department. This wagon makes a speed of 12 to 14 miles per hour, and is capable of doing about 40 miles per charge. This is about the maximum number of miles over which deliveries can be made in a single day by two men. On the battery box is marked "Electric Wagon Operated by Edison Current." This vehicle will travel twice as fast as a horse and do double the work per day. The car replaces an older one, and the improvement in design is shown in the table:

	Old car.	New car.
Weight of battery, lb	2,000	1,050
Weight of two motors on old car, lb	500	....
Weight of one motor on new car, lb	....	200
Weight of car, lb	4.850	3,240
Mileage	25	40
Cost for energy, 4 cts. per kw-hour, cents	84	44
Cost of energy per mile, cents	3.6	1.1

The Narragansett Electric Light Company, of Providence, R. I., uses an electric pump wagon which will pump out a manhole in 15 minutes against two hours' work by three men under the old régime. For electric light and telephone work a vehicle properly equipped will draw 280 ft. of cable in 7 minutes against 30 minutes required by six men with a hand-windlass. The New York Telephone Company finds that an electric truck will do about double the work of a two-horse heavy truck. The truck is equipped with an electric winch for hauling cables and with a pair of shears for pole-setting. This vehicle will accomplish in half the time what formerly called for a portable derrick and from 8 to 10 men. The Western Electric Company has had an electric truck in service since 1906 in competition with regular two-horse trucks with the result that from 75 to 100 per cent more work is done. The Adams and American express companies are making extensive use of the electric vehicle, the former company having over 300 electric machines. The latter company is said to save 22 per cent on deliveries and 39.6 per cent on transfers over and above horse costs, including interest, depreciation and all operating expenses. Traffic room in the streets is increased 200 per cent by the use of electric vehicles.

Development of the Central Georgia Power Company, of Macon, Ga.

By S. Mays Ball.

A total amount of $36,000,000 will be spent in water-power development within the State of Georgia within the next few months, according to the officials of the Central Georgia Power Company, of Macon, Ga. Interested in the Central Georgia Power Company are some of the strongest financial interests in the United States and Canada. Among the number may be mentioned A. B. Leach & Company, of New York; J. E. Aldred, of Montreal, vice-president of the Shawinigan Water & Power Company; H. S. Holt, of Montreal, largely interested in Canadian Pacific railways and one of the wealthiest men in America; F. B. Schenck, of New York, president of the Liberty National Bank; J. I. Buchanan, of Pittsburgh, president of the Pittsburgh Trust Company, and a score of other wealthy men of New York, Boston, Pittsburgh, Chicago, Montreal and other cities in the North and East.

In addition to the large dam being built across the Ocmulgee River eight miles from Jackson, Ga., which will when completed generate 20,000 hp, immense dams will be built on the Flint and Oconee rivers. The Central Georgia Power Company, of Macon, which is constructing the large dam near Jackson, Ga., will also build the dams across the Oconee and Flint rivers. The dam on the Oconee River will be located near Milledgeville, Ga., and will, it is said, be by far the largest water-power plant in the South, generating when completed 45,000 hp. The dam to be built across the Flint River will be located near Reynolds in Taylor County, Ga., and will also be one of the largest plants in the South. Work on the latter plant will begin within the next 30 days.

Nearly 500 men are now at work on the $3,000,000 dam near Jackson referred to above. This dam will be completed by Jan. 1, 1910, and will then be ready to distribute power to middle and central Georgia. The output will be used in mills and factories and for lighting the streets and homes of Macon, Monticello, Forsyth, Griffin and Jackson. It will also operate the trolley line now under construction between Macon, Ga., and Atlanta, Ga. Work on the interurban line, which has been at a standstill for a week or so, will be resumed within the next few weeks, the money, it is stated authoritatively, being all in sight.

The Flint River, it is reported semi-officially, will generate sufficient power to supply southwest Georgia, Albany, Americus, Bainbridge and other adjacent towns.

Following in the wake of this development will be many trolley lines which will connect almost every part of the State. The road from Macon to Atlanta, mentioned above, is part of this project, as is one to run from Macon south to Albany and other points in the fertile southwest portion of the State. An interurban line from Macon to Indian Springs, the well-known health resort, and then on to Jackson, Ga., it is reported, will be built so soon as the power is available.

President W. J. Massee, of the Central Georgia Power Company, states that his company is flooded with letters from people in the East anxious to move their plants into his territory, or to put up new plants to take advantage of the very cheap power in view. The rains have kept back slightly progress on the dam near Jackson, on the Ocmulgee, but the work is being rushed at this time. The dam is being built in 45-ft. sections. The fourth section is also under construction. These sections run to a height of 30 ft., will extend across the river, and then be raised to their final height of 100 ft. The dam will be more than 1200 ft. in length, 100 ft. high, 93 ft. at the base and 8 ft. and 9 ft. at the crest. A minimum of 16,000 hp, and a maximum of from 23,000 hp to 25,000 hp will be generated at this dam. The foundations are built firmly in the river, the base going 16 ft. below the bed of the river, which is of rock. This dam will be the largest in the State of Georgia and there are quite a few good-sized ones therein. But the one on the Oconee River above referred to will make the Ocmulgee River dam look insignificant. For instance, the Ocmulgee dam will back water 14 miles up the river and cover 3000 acres of land which has been purchased at an average price of $20 per acre, while the Oconee dam will cover by its backwater probably more than 12,000 acres of land. Every bit of the underbrush will be cleared away before the water is turned on at the Ocmulgee dam. There are 150 men at work on clearing-off the ground to be covered by water. The contractors, Lane Brothers & Company, will complete the Ocmulgee dam, so they say, by Jan. 1, 1910. Work is now being done by both day and night forces.

Mexican Electrical Development.

Following is further information in relation to a large projected electrical development in northern Mexico to which reference was made in the issue of March 25.

The company concerned, the Mexican Northern Power Company, includes some members of the syndicate of Canadians who installed the great hydro-electric power plant and system of transmission lines at Necaxa, near Mexico. The present concession is for the establishment of a hydro-electric plant on the Conchos River at a point 17 miles above the town of Santa Rosalia, State of Chihuahua. This concession is now nominally owned by Juan A. Creel and Joaquin Cortazar, both of the city of Chihuahua, and Paul Ginther, of Santa Rosalia. The syndicate has already acquired a site for one of its proposed hydro-electric plants to be erected on the Conchos River at La Joya. Engineers are also now investigating a proposed site near Santa Rosalia. It is stated that by building a dam 60 m high across the Conchos River near Santa Rosalia 24,000 hp can be developed. The proposed dam will impound 1,840,000,000 cu. m of water, making a lake that will cover 100 sq. miles of territory. The concession also authorizes the use of the impounded water for irrigation purposes.

It is claimed that from this lake 150,000 acres of land in the Conchos River valley can be irrigated. The company expects to begin the erection of these two hydro-electric plants within the next three months. Transmission lines will be built and the electric power distributed to towns and mining camps within a radius of 200 miles. The Federal concession for the proposed hydro-electric plant at La Joya was owned by Messrs. Schoendube and Neugebauer, of Mexico. It is stated that about 15,000 hp can be developed at La Joya, making a total of nearly 39,000 hp for the two plants. The La Joya is situated about 90 miles from Chihuahua and 65 miles from Parral, the two chief cities of the State.

The Mexican Light & Power Company has resumed construction work on its big Tescapa dam, which is a part of the Necaxa system of water-storage reservoirs in the mountains near Necaxa. Considerable tunnel work is also being done in connection with this system. The Necaxa dam is nearing completion.

An electric light plant is being installed at Santa Rosalia, State of Chihuahua, by the Compania Productora de Hielo y Electricidad.

The firm of Veyan, Jean & Company, which has entered into a contract for lighting Mexico City, is installing a large hydro-electric plant, which it expects to complete inside of a year. It is building a canal from the Alameda River, from which the initial power will be obtained. The firm expects to have its lighting system completed and ready for inauguration by September, 1910.

It is reported that the Compania de Tranvias, Luz y Fuerza, which owns the electric street railway, steam and lighting and power plant in Guadalajara, is negotiating for the purchase of the concession owned by Manuel Cuesta Gallardo, for the establishment of a complete lighting and power system for that city. Mr. Gallardo has planned to erect a large hydro-electric plant on the Santiago River, near Guadalajara, and not only transmit the electrical energy to that city, but also to supply the power for operating large irrigating pumps at Lake Chapala.

The Compania de Tranvias, Luz y Fuerza was recently reorganized. It now has a capital stock of $6,000,000. Fernando Pimentel y Fagoaga, of Mexico, owns a majority of the stock in the company.

William A. McClaren contemplates installing a hydro-electric plant on the Fuerte River, in the State of Sinaloa. Emanuel Amor has applied to the Government for a concession to utilize the water of the San Geronimo River for the operation of a hydro-electric plant which he will install in the State of Morelos. The Compania Hidro-Electrica Queretana will erect another dam on the San Juan River, in the State of Queretaro, to provide additional power for operating its hydro-electric plant.

David John Pullinger has obtained a concession from the Federal Government for the construction of a dam on the Presa River, in the State of Durango, to provide the initial power for a hydro-electric plant which he will erect there. He expects to generate 2000 hp. W. O. Temple is arranging to install a hydro-electric plant on the Mayo River, in the State of Sonora. The Compania Salinas de Mexico is electrifying its large salt-refining plant at Salinas, State of Coahuila. It will obtain its power from the plant of the Benito Jarez Mines Company. The Federal Government has granted authority to Jose Luis Requena to install a hydro-electric plant on the Tepeji River, in the State of Hidalgo. The first electric lighting plant in the State of Campeche was inaugurated on March 31 in the city of Campeche by the Campeche Light & Power Company. The event was marked with elaborate official ceremonies in which the Governor of the State, Tomas Azmar y Cano, took a leading part. The celebration consisted of a grand display of fireworks, a ball in the Governor's palace, special fiesta observances in the plazas, band concerts, a performance by the local dramatic society and a banquet. The plant is of 750-hp capacity. The town has 20,000 population and has six suburbs. There are other towns of considerable size in the State which have no electric light plant.

The opening to the outside world of a stretch of several hundred miles of territory bordering on the Pacific Ocean by the building of a railroad down the western slope of Mexico has awakened a keen interest in the possibilities of large hydro-electric projects on the part of American investors. It is stated that in the mountains, which abruptly border the costal plain, are many rivers and waterfalls which would afford an abundance of power for hydro-electric plants. There are many rich mining camps and growing industrial centers scattered through that region which would consume a large amount of power, it is claimed. Several engineers are now in the field in various localities making investigations in the interest of parties who contemplate installing hydro-electric plants.

Northwestern University College of Engineering.

The new College of Engineering of Northwestern University, at Evanston, Ill., reference to which appeared in the issue of April 1, will be in full operation at the beginning of the school year next autumn. The director is John Fillmore Hayford, C.E., while Prof. O. H. Basquin, associate professor of physics, is acting as secretary of the engineering faculty. Dr. Henry Crew, for a number of years professor of physics at Northwestern University, is also a lecturer in the school of engineering.

A five-year course of study is planned. The studies of the first four years of this course fulfil all requirements for the liberal arts degree of bachelor of science, which will be conferred on students at the end of this term. On the completion of the full five-year course a bachelor's degree in engineering will be given. In the third year the course in physics will embrace electricity and magnetism. Direct-current work will be taken up in the fourth year, and alternating-current phenomena and applications in the fifth year.

In general, it may be said that the purpose underlying the instruction in the new College of Engineering is to teach broad, fundamental principles, devoting special attention to the cultural studies in the earlier years of the course, allowing students to specialize in the later years. The idea is to develop general education and to cultivate the thinking power of the student. Much attention is paid to mathematics, physics and other sciences fundamental to engineering. Practical work is to be given as much attention as is consistent with the purpose of the school. There will be summer terms, and the time gained in these summer terms and by adding a year, making a five-year course, is thought to be sufficient to take care of the practical work. No effort will be made to compete with schools giving primary attention to practical training, as opposed to the more general, cultural work at Northwestern. Another characteristic of this school will be that the various branches of engineering will not be so sharply differentiated as in some other institutions. No effort will be made to attract a very large number of students; the intention is to give a very thorough, fundamental training to those in residence.

The school will be housed in the new Swift Hall of Engineering which has just been completed. This is a stone building overlooking Lake Michigan, 54 ft. wide and 125 ft. long, comprising three stories and a basement and attic. The engine, dynamo and motor laboratories will be in the basement. Steam from the university power plant will be transmitted to the building at high pressure, and will be utilized for experimental purposes. Other prime engines, such as gas engines, will be placed in the engine laboratory. On the first floor is a lecture

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hall seating 200 persons and a laboratory for the study of hydraulics. The second floor will be given up to a laboratory and lecture-room in mechanics, a library, a room for the Engineering Club and recitation-rooms and offices. A large drafting-room, especially well lighted from the roof and by side windows, will take up a portion of the third story. Here also will be temporary offices and classrooms for the department of mathematics.

The building is the gift of Mrs. Gustavus F. Swift, of Chicago, and is a tangible evidence of part of the $1,000,000 which was raised in behalf of the university two or three years ago. Mr. Edward F. Swift, a son of Mrs. Swift, at the same time gave $50,000, the interest upon which is to be used for the maintenance of the building. The interior of the building is constructed with concrete foundations, brick walls, and reinforced concrete floors and stairways. The surfaces of the floors and stairways are of smooth-finish concrete. The only wood used is in the doors and window casings and in the rafters of the roof.

Conduits for distribution of electricity have been generously provided throughout the building. Provision is also made for a system of vacuum cleaning. The plans for instruction in electrical engineering or for the electrical laboratory equipment are not entirely complete, but by the fall it is expected to be in position to handle a limited number of students.

The building will be dedicated early in May. Mr. Charles Whiting Baker, editor of the *Engineering News*, will give the principal address.

Power Development of Twin City Rapid Transit Company.

Mr. Edward H. Scofield, mechanical and electrical engineer of the Twin City Rapid Transit Company, lectured before the senior electrical engineers of the University of Minnesota, Wednesday, April 7, upon "The Development of the Power System of the Twin City Rapid Transit Company." Beginning with the days when cars were drawn literally by horse-power, Mr. Scofield outlined the various steps in the development of the power houses to meet the ever-increasing demands for power. In the early days of the system small electrical generators were driven by triple-expansion Corliss engines, through long lines of shafting, the 150-hp generator being the largest obtainable at that early day. Triple-expansion engines were used because of the high economy of steam obtained by them in running under favorable conditions. The extreme fluctuations in the load which characterized electric railways were found to make such high efficiencies unattainable, and the violent changes of load were found to be destructive to the engine, involving heavy repair and maintenance expenses. The triple-expansion engines were succeeded by compound vertical Corliss engines. The latest additions to the steam plant have been steam turbo-generators. The economy of water-power was early recognized and the "lower dam" was built half a mile below St. Anthony Falls, where the maximum of 10,000 hp became available. As one result of the control of the Mississippi River by the Government reservoirs, the flow has been more uniform so that it has been possible to develop more power at St. Anthony Falls, 12,000 hp being available at this new plant during times of normal water and on Sundays when many of the mills are closed. The establishment of the main steam plant close to the river and adjacent to the railroads, together with the installation of modern coal-handling and stoking apparatus, has rendered possible the substitution of slack coal for the more expensive grades formerly used. Fortunately, there is plenty of water during the months when slack coal is scarce. For the last 10 years the demand for power has increased at the nearly constant rate of 20 per cent annually. The extension of the system, including suburban lines, has required the adoption of alternating current for transmission and distribution to numerous substations, where the power is changed to 600-volt direct current for the trolley circuit. Detailed descriptions of the equipment of the power stations and substations were given in the *Proceedings* of the American Institute of Electrical Engineers for February, 1907.

Hearing by Massachusetts Commission on Minimum Meter Charge.

The Massachusetts Gas and Electric Light Commission gave a hearing in Boston on April 6 on the petition of Joseph Leonard for the reduction or abolition of the minimum monthly charge of $1 maintained by the Edison Electric Illuminating Company for electric lighting service. The Edison company was represented by President Charles L. Edgar, General Counsel Everett W. Burdett, J. W. Cowles, superintendent of the meter department, and other officials. For the petitioners Mr. Leonard argued that the present minimum charge is too high, and called attention to the differences in rates in buildings where the tenants are metered separately by the central station and where the landlord pays for the energy used and includes the charge for light in the rent.

Under cross-examination Mr. Leonard admitted that a 50-cent minimum charge on a gas-meter installation was more reasonable than $1. His chief objection is to the amount of the charge rather than to its propriety. He had made no study of the proper charge, and if $12 per annum were not enough to cover actual cost of meter maintenance, he could not object to the present charge. This was the point which the commission should investigate, however. Mr. Burdett showed that when the tenant's energy charge is included in his office rental he is likely to assume that the lighting costs him much less than when it is not included in the rental. Mr. Leonard admitted that differences in the conditions would call for a difference in prices.

Mr. Burdett then stated that one of the most important results of the minimum charge is that it saves the company from the accumulation of a mass of dead capital, on the greater portion of which no return is obtained. The meter charge is really an attempt to keep the company from loss in allowing meters to stay on a location where energy is not used to the amount indicated by the minimum charge. The cost to the company for meter maintenance in these small sizes is over $12 per year. When the customer faces a minimum charge he takes pains to inform the company when he leaves the premises for good. The Boston Consolidated Gas Company found over 3500 idle meters on its system when it inaugurated a minimum charge about two years ago. Leaving a meter in an abandoned office or other place where it stands dead involves rapid and serious depreciation, and the prevention of this by the minimum charge tends to keep the insulation in good shape through attention and to protect life and property.

President C. L. Edgar testified that while there is undoubtedly a general feeling against meter rentals, such a charge is purely nominal. Without the minimum charge there would never be customers disconnected, and now thousands of disconnections occur yearly. The income from minimum charges is only about $20,000 per year. The meter minimum is merely a local charge. If it did not cost the company anything to maintain the meter the charge would still be necessary. The question of minimum charge has little effect on the introduction of electricity into residences; the chief difficulty here is the cost of wiring.

Mr. J. W. Cowles, in charge of the Edison company's meter department, then testified that the estimated cost of maintaining small meters of the sizes in which the petitioners are interested is as follows:

ESTIMATED COST OF YEARLY MAINTENANCE—$12 METER.

One yearly test	$1.00
Reading monthly, per year	.50
Billing	2.00
Postage	.24
Repairs	1.00
Twenty per cent interest and depreciation	2.40
Lost revenue from exciting current (40 kw-hours), at 12 cents	4.80
Total	$11.94

Mr. Cowles estimated that if a meter is disconnected and left idle an extra test costing $1 will be necessary, and also extra repairs to an average of $1.50. The depreciation is greater when the meter is left idle on account of dampness, wide temperature variations, etc., and there is a marked difference in the abnormal repairs necessary. An open circuit in the shunt coil may cost 50 cents to repair, whereas if one occurs in the armature, it may cost $3.60 to replace it. The cost of individual meter tests runs from 74 cents to $15 each in the larger sizes, but a fair estimate for the smaller sizes is $1 each. The company last year made 27,000 meter tests on its system, and the average cost of each test was $1.20 for all sizes of meters.

At the request of the commission the company will prepare further detailed data as to the cost of meter maintenance. The hearing was continued to April 13.

Annual Report of Massachusetts Gas and Electric Light Commission.

The Massachusetts Gas and Electric Light Commission has submitted its twenty-fourth annual report for the year ended June 30, 1908, to the Legislature. The volume includes the usual introductory discussion of important changes or additions to the lighting companies of the State, recommendations for legislation, orders, decisions, statistics of gas plants, electric plants, operations of companies and municipal data, inspection, testing records, violations of law, special reports and accident records, with full appendices giving the detailed operating results of municipal and private companies. The report contains

the returns of 72 gas companies, 56 electric light companies and of 16 persons or manufacturing companies engaged in making or selling gas or electricity for light or heat. Twenty-four gas companies supply electricity and 26 municipal plants made returns to the board. Six new companies were chartered in 1908 with gas or electric lighting powers, and five corporations were chartered for fuel and auxiliary purposes.

The board recommends that legislation be enacted to bring the so-called anti-stock watering laws affecting gas and electric companies into substantial conformity with the 1908 act which permits railroad corporations and street railways to offer new stock to their stockholders at such price not less than par as the Railroad Commission deems to be in the public interest. Supervision would be by the Gas and Electric Light Commission. The board states that "some considerations vitally affect the policy of the existing law with respect to gas and electric light companies which are not so apparent to other public-service corporations. The market value of stock is determined perhaps quite as much by the earning power of the stock and consequent potential dividend as by its established dividend and the relation of its dividend to the prevailing rate of interest.

"Gas and electric companies sell but one commodity or service, or at most two, and the earning power is directly determined by the prices which they charge. The present law expressly provides that stockholders shall not be entitled to take additional issues of less than the market value thereof. To the extent to which the market value is determined by the earning power, the effect of the actual application of the law is to capitalize as against the public the existing earning power of the company, regardless of whether that earning power is based upon reasonable prices for the gas and electricity supplied, or not . . . The continued prosperity of the larger gas and electric light companies, the growing tendency to more widely recognize their desirability as safe and permanent investments, and their gradually increasing rates of dividends are steadily forcing up the market prices of their stocks, and the effect of the actual law is to work disadvantageously to the public."

To remove any doubt as to the meaning of Section 5, Chapter 529, Acts of 1908, the board recommends that a gas company shall be distinctly authorized to sell its electrical business and property to an electric light company whose lines are in the same or a contiguous municipality, under the supervision of the commission.

During the fiscal year the approval of the board was given to the issuing of $1,487,200 capital stock, par value, and $200,000 in bonds by gas and electric light companies.

The gas companies of the State earned $10,433,307 in 1908, compared with $9,789,482 in 1907. Their total operating expenses for 1908 were $7,690,012, compared with $6,997,830 in 1907. The gas companies had a surplus of $3,583,412 in 1908 and $3,203,469 in 1907. They declared in dividends $2,826,039 in 1908, against $2,314,661 the year before. Twenty-nine declared no dividend. The total assets of the gas companies on June 30, 1908, were $60,028,172 and in 1907 $55,270,896. The gas companies paid in taxes $672,834, including State supervision, or 6.2 cents per 1000 ft. of gas sold. The average price paid for coal gas by meter was $0.948 per 1000 ft., compared with $0.998 in 1907.

The electric light companies earned a total of $10,401,550 in 1908, against $9,776,430 in 1907. Their total operating expenses for 1908 were $6,145,599, compared with $5,715,467 in the preceding year. The gas companies made net profits of $838,994 in their electrical departments in 1908, as against $789,618 in 1907. The apparent profit for the year was $151,152 compared with $259,804 in 1907. The dividends declared in 1908 were $2,019,933, as against $1,826,802 in 1907. Thirty-one companies paid no dividend. The gross profits of electric lighting increased nearly $200,000 in the year 1908. The total assets of the electric light companies in 1908 were $41,034,852, compared with $38,897,967 in 1907. The actual surplus was $2,828,516 in 1908 and $2,490,760 in 1907, or 13.78 per cent on the capital in the former year and 12.14 per cent in the latter. The electric companies paid in taxes in 1908, $1,393,119, and the rate of dividends averaged 9.65 per cent on the stock of these companies.

High-Tension Transmission Apparatus.

The meeting of the American Institute of Electrical Engineers on April 9 was held under the auspices of the high-tension transmission committee. Mr. K. C. Randall presented a paper describing high-voltage transformers and protective and controlling apparatus for outdoor installation. Transformers rated at as high as 500 kva have been built for this purpose, and units for potentials up to 60,000 volts are in service. Well-made gasketed joints, with deep, overhanging eaves and carefully sealed-in outlets, have been found to give good results in rendering the transformer cases weather-proof. Non-freezing oil should be used in order that operation in severe weather may not be endangered. By treating the high-tension transformer as part of the line all switching could be done on the low-tension side, and when necessary fused knife switches on the high-tension side would serve to disconnect the transformer.

The advantage of outdoor apparatus lies in cheapening the installation due to a saving in building; there is also less life and property hazard. The disadvantages are absence of protection from weather when inspecting, overhauling or making repairs, and exposure to molestors. The problem, as a whole, was, first the transformer; second, the switch; and, third, the protective apparatus. The author stated that all of these have been worked out and some experience obtained. The problem now is to decide when outdoor apparatus is warranted. This is a question of the station rather than the apparatus, and is subject to the individual conditions of each case.

Mr. A. B. Reynders read a paper outlining the theory upon which the construction of the condenser type of bushing is based. When uniform insulating material is used for separating a conductor from the case, the dielectric near the conductor is subjected to greater electrostatic stress than is that near the core; when the former stress exceeds a certain value the whole insulation gives away. By inserting conducting sheets throughout the insulating material the mass is divided into numerous small condensers between which the impressed e.m.f. is divided in inverse proportion to the capacities of the various condensers. In practical application of the above principles, the bushings are constructed by rolling up on a metal tube, paper and mica, or paper alone, using as a bond some material like shellac. At regular increases by steps in diameter, for example 1/16 in., a layer of tinfoil, making one complete turn, is inserted during the rolling process. Great care is exercised to obtain accurate diameters, especially when the thickness of insulation is small. No air space or wrinkling of the paper is allowable, or poor results will inevitably follow. After being completely wound, the tube is placed in an ordinary engine lathe and the ends are tapered in steps, the amount of taper depending on whether the end is immersed in oil or surrounded by air. After the turning process is completed, the entire terminal is treated with some insulating varnish in order to prevent the absorption of oil into that portion projecting into the oil, and the absorption of moisture in that portion which is in air.

With a bushing constructed by the above method, there yet remains one point of weakness; namely, the edges of the tinfoil are sharp, and the potential which exists between these edges and ground may be high enough to cause corona effects in the surrounding medium. A remedy is found in making the radius of the end of the tinfoil layer large enough to reduce the stress to safe limits; a metal ring of suitable diameter is placed at the corners where the tinfoil ends. For outdoor service a bell-shaped metal cap is placed in electrical contact with the metal layer.

DISCUSSION.

Mr. W. S. Moody called attention to the fact that when concentric cylinders are inserted throughout insulating material all

of the insulation defects are placed directly in series so that there is greater danger from destruction by conduction. He stated that six years ago there had been constructed an 80-in. terminal that has withstood 500,000 volts and is still in service. The bushing consists of a tube of low-grade insulating material tapering in diameter both ways from the point at which the lead is supported, which tube is filled with a high-grade insulating liquid such as oil or asphaltum.

Mr. P. H. Thomas remarked that the difficulties encountered in insulating a terminal passing through a metallic case can be greatly reduced by employing a conductor of large diameter and providing an extra large opening through the case. He stated that the method suggested by Mr. Randall is open to the serious objection that the apparatus will be exposed to the weather at the time when inspection and repairs are necessary.

Mr. D. B. Rushmore said that the outdoor installation can never compete with the indoor on the basis of the operating features, but it may possess some few economical advantages for substations of limited output. Considerable difficulty has been encountered in finding a non-freezing liquid suitable for the electrolyte in lightning arresters; however, such a liquid is in use at the present time.

Mr. P. M. Lincoln expressed the opinion that the condenser-type of bushing represents the greatest advance made in high-tension apparatus during the last four years. The bushing is so constructed that the weak spots in the insulation are eliminated; that weak spots are placed in series is of no importance.

Mr. E. M. Hewlett explained that it is possible to construct a simple bushing possessing a breakdown e.m.f. equal to the equivalent spark-gap corresponding to its length, so that it is unnecessary to resort to the complications of the condenser-type.

Mr. S. Piek stated that the possibility of installing high-tension apparatus outdoors is shown conclusively by the successful operation for several years of 60,000-volt outdoor series transformers on the lines of the Niagara, Lockport & Ontario Power Company.

In commenting on a communication by Mr. J. S. Peck in which attention was called to the desirability of operating the transformers in "star" with grounded neutral in order to avoid the necessity for insulating one of the terminals, Mr. Ralph D. Mershon stated his belief that for very high-tension work both the primaries and the secondaries of the transformers should be joined in "star" with grounded neutrals. In this way each wire could be considered as belonging to a single-phase system with ground return. The switches could be of the single-phase, single-pole type operated simultaneously under normal conditions and independently in case of necessity. All measuring apparatus could be on the grounded side of each single-phase line, and hence would not require high-tension insulation.

During the evening practical demonstrations were made of the efficacy of the condenser type of terminal. When two similar terminals, one having solid insulating material and the other being built up of alternate layers of insulating and conducting material, were tested it was found that the latter withstood more than double the e.m.f. required to cause an arc to be produced across the former. The e.m.f. which reached values as high as 250,000 volts during rain tests on transformer terminals was produced by means of apparatus furnished by the Electrical Testing Laboratories and the New York Edison Company. President Ferguson being unable to be present on account of sickness in his family, Mr. J. G. White, senior vice-president, served as the presiding officer.

Inventory and Appraisal of New England Telephone & Telegraph Company.

Prof. Dugald C. Jackson, of the firm of D. C. & William B. Jackson, engineers and experts, Chicago and Boston, has submitted a summary report of the inventory and appraisal of the property of the New England Telephone & Telegraph Company, made for the Massachusetts Highway Commission during the past year. The total value of the company's property is estimated at $46,540,819. Of this the property valuation in Massachusetts is $34,133,270, and the valuation in adjacent States is $12,407,549. The company has 247 exchange central offices which provide telephone service for substantially all of Massachusetts. Of these offices 46 are located in buildings owned by the company. The number of operators' positions at exchange switchboards is 2367. The length of telephone conductors in the Massachusetts system is sufficient to provide nine complete two-wire metallic circuits around the equatorial circumference of the earth.

EXHIBIT I.—INVENTORY SHOWING EXTENT OF PLANT IN MASSACHUSETTS.

Buildings owned by company		53
Parcels of land owned by company		54
Exchange central offices		247
Operators' positions at exchange switchboards		2,367
Length of pole lines (approximate), miles		3,837
Length of underground conduits	feet	3,100,901
	miles	587
Underground ducts	feet	14,370,649
	miles	2,721
Manholes in underground conduits		11,217
Aggregate length of pole lines and conduits, miles		4,424
Length of open wire on pole lines	miles	67,599
	feet	5,264,160
Length of aerial cable, miles		997
Length of conductors in aerial cables, miles		66,836
Total length of overhead conductors	miles	134,435
	feet	6,663,360
Length of underground cables	miles	1 262
	feet	52,800
Length of submarine cables, miles		10
Length of conductors in underground and submarine cables, miles		318,225
Aggregate length of aerial, underground and submarine cables, miles		2,269
Aggregate length of telephone conductors in all cables and wires, miles		452,660
Number of poles		310,138
Number of subscribers' telephones on Aug. 31, 1908		199,382

Exhibit 1 shows the extent of the company's plant in Massachusetts and Exhibit 2 shows the total value of property in Massachusetts divided as in Exhibit 1. The value given for each kind of property in Exhibit 2 includes the value of all the collateral materials that accompany the particular main division.

The appraisal shows that the total value of the physical plant used for local service is $22,885,082. The total value of local plant in metropolitan Boston is $4,463,843, and in the suburban district immediately surrounding, $6,446,838. The total value of local plants in the 11 cities of the State, which are of substantially 50,000 inhabitants or over is $6,872,411. The remainder of the local plants in the smaller cities and rural districts amounts to $5,979,248. The total value of the toll plant is $9,641,913, which is 42 per cent of the value of the local plant. The average net current assets and cash on hand which enter into the company's capital amount to $1,560,000. This represents the funds that are required in its current operations.

When the appraisal was taken in midsummer of 1908 there were 42,749 telephones in use in metropolitan Boston; 34,888 in the inner zone of the suburban district; 19,456 in the outer zone; 56,729 in use in the 11 cities mentioned as a group before, and 54,540 in use in the remainder of the State. These are distributed as 20,201 main telephones; 17,143 private branch exchange terminal telephones, and 5405 extension sets connecting with 19,159 subscribers' circuits in the metropolitan district. There are 29,672 main telephones, 2519 private-branch instruments and 2697 extension sets connecting with 16,556 subscribers' circuits in the metropolitan district (five-mile radius of Boston); 16,875 main telephones, 702 private-branch instruments, and 1879 extension sets connecting with 8770 subscribers' circuits in the outer zone of the suburban district. In the 11 principal cities outside Boston there are 45,516 main telephones, 5113 private-branch instruments, and 6100 extension sets connecting with 23,581 subscribers' circuits. In the remainder of the State are 48,558 main telephones, 1892 private-branch instruments, and 4090 extension sets connecting with 19,399 subscribers' circuits. The inventory shows in detail the number of each kind of circuit and telephone for each of the 241 sections. The inventory and appraisal show accurately how much and what kind of property the company possesses in all parts of the territory which it serves.

The appraisal shows that for each $100 worth of property the

company has outstanding $83.67 of par value in stocks, bonds and notes. The aggregate value of the entire property and a comparison of it with the total outstanding securities are shown in Exhibits 4 and 5. It appears that the company has been paying for such expenses as engineering and interest, especially on new construction, out of earnings instead of out of its capital account. The appraisal shows that the company has no water in its securities; affords information on which the commission can decide how much money the company should be allowed to return on its investment, and how much it should be

EXHIBIT 2.—APPRAISAL OF PROPERTY, SHOWING VALUE OF PROPERTY BELONGING TO BUSINESS IN MASSACHUSETTS.

Substation equipment	$3,217,240
Drop wires leading to subscribers' premises	668,315
Poles and fittings	4,260,173
Conduits and manholes	7,588,632
Wires on poles	2,724,017
Aerial cables	1,465,213
Underground and submarine cables	4,718,066
Switchboards	4,094,067
Furniture and tools	453,078
Land and buildings	2,344,469
*General supplies	1,040,000
†Net current assets and cash on hand	1,560,000
Total	$34,133,270

*Book value, from Auditor.
†Round figure representing average condition.

reasonably expected to expend in the average year for reconstruction, against the ravages of age or obsolescence.

As a result of the study of the complete plant, Professor Jackson applied percentages to each kind of construction involved, considering first cost, rate of depreciation, probable effects of changes in the art and the acts of municipal bodies, special misfortunes due to the elements and any salvage that might be recovered from discarded plant. In this way a figure of 7.3 per cent is reached for the average yearly reconstruction account for the property (exclusive of land, general supplies and working capital) used in Massachusetts business, or $2,240,000 on the existing plant. It seems proved that the

EXHIBIT 3.—APPRAISAL, SHOWING VALUE OF PROPERTY BELONGING TO BUSINESS OUTSIDE OF MASSACHUSETTS.

Apparatus and equipment	$9,771,766
Land and buildings	210,783
*Investment in other companies	1,945,000
†Net current assets and cash on hand	480,000
Total	$12,407,549

*At cost value, from auditor.
†Round figure representing average condition.

company is not building extensions out of annual receipts under color of the reconstruction account, and the exacting inspection of the plant shows that it is maintained in excellent condition.

The appraisal puts the board in possession of standards by which to measure the reasonableness of the total sum annually collected by the company from its subscribers, but fuller traffic data and apportioned cost records must be gathered and analyzed before recommendations as to the company's relative treatment of localities and classes of customers can be put on a firmer foundation. There appears ground for an early revision of rates in the Boston metropolitan and suburban dis-

EXHIBIT 4.—APPRAISAL, SHOWING DIVISION OF PROPERTY VALUE BETWEEN THAT IN MASSACHUSETTS AND THAT OF ADJOINING STATES, TOGETHER WITH THE TOTAL VALUE OF PROPERTY.

Value of property in Massachusetts	$34,133,270
Value of property adjoining Massachusetts	12,407,549
Value of entire property of the New England Telephone & Telegraph Company	$46,540,819

tricts. The great importance of a full and comprehensive telephone service and the large part which the telephone plays in the business welfare and social convenience of the State justify further expenditure for a traffic, rate and cost study. Improved methods of accounting are desirable to show more fully the effect of changes in the rates for any particular service.

Additional complexity is introduced into the rate question by the relations of the toll service to the local service. In the appraisal the two classes of plant were carefully separated, but further figures and more careful means of separating local and toll operating results are needed. Figures for gross receipts seem to indicate that at present the long-distance toll system is not earning its own operating expenses, reconstruction charges, and return on the investment.

The report concludes with a recommendation for a further appropriation to enable at least a year's study to be given to the

EXHIBIT 5.—APPRAISAL, SHOWING VALUE OF PROPERTY COMPARED WITH OUTSTANDING SECURITIES OF TELEPHONE COMPANY.

Appraisal value of entire property of New England Telephone & Telegraph Company	$46,540,819
Total par value of the company's outstanding stocks, bonds and notes, as given by the company's auditor for Aug. 31, 1909	$38,939,850

traffic and rate problem in a way that shall serve to establish a sound basis upon which future rate problems may be adjudged. Within a short time it is expected that certain recommendations will be made as to the rates in the Boston and suburban districts as a direct result of the appraisal now completed.

Final Hearing on Franchise of Connecticut River Transmission Company.

As noted in our issues for Feb. 11 and 25, the Massachusetts Gas and Electric Light Commission has given hearings on the appeal of the Fitchburg Gas & Electric Light Company against the franchise of the Connecticut River Transmission Company, on Feb. 3, 9 and 19. A continued hearing was given on March 12, at which time Mr. E. W. Burdell, counsel for the Fitchburg company, showed that the minimum charge brings in a revenue of only $845 out of a total of $44,000 received from the sales of energy for motors.

Among those who testified were F. P. Royce, vice-president of the Fitchburg company; Charles L. Edgar, president of the Edison Electric Illuminating Company, Boston; A. S. Pratt, of Stone & Webster, and Philip Cabot, president of the Turners Falls Power Company.

Mr. Cabot submitted a report by the law firm of C. S. Davis & W. Rodman Peabody, Boston, an abstract of which is given herewith: "The question for the Massachusetts commission to consider here is not whether competition will cause an immediate lowering of the price of power for these particular consumers, but whether it will bring the price to a permanent lower level than will a regulated monopoly.

"If a central station is to be regarded by the State as the natural agent for the supply of electricity in the district which it serves, it should be required to furnish such energy at the lowest reasonable cost. If it can produce such energy more cheaply from water-power than from a steam plant, it should do so, and vice versa. If a combination of plants gives the most economical results, well and good. If a steam auxiliary must be maintained for emergency service, the charges upon it must be considered in all rate making.

"If electrical energy manufactured by a water-power company should be distributed locally by the existing central station, the price which the consumer pays will naturally be based upon the cost of producing electricity, transmitting it, distributing it and of maintaining reserve steam-plant capacity. It may well be that the same management shall control the whole transaction. The small consumer has no reason to object, since the transmission company cannot bring power to the city and distribute it more cheaply than the local company can distribute the power which it buys from the water-power organization. If the consumer purchases surplus power from the water-power enterprise for only a part of the year, he cannot expect to buy steam-generated power in emergencies from the local lighting company at the price it could afford to make him on longer-term contracts. If the local company loses much of its motor business it will have to charge a higher price for lighting. The true remedy for the small consumer who finds that the local company is selling at too high a price is to appeal to the commission and have the equitableness of the rate adjudicated."

The latter portion of the report discusses the history of the London & District Electric Supply Company's plans as the matter has been considered in Parliament and by the Board of Trade. The parallel is drawn between the Connecticut River case and that of the London company, and the report concludes by stating that the London matter has finally been postponed for another year as a result of the adverse report of the House of Commons against the undertaking of supplying electrical energy in the local fields to large consumers and in bulk to the authorized distributors of the territory from a central generating plant of the London & District Supply Company.

At the final hearing on the appeal held April 8, arguments were presented by Counsel Everett W. Burdett, Esq., Boston, for the Fitchburg company, and by Counsel Jeremiah Smith, Jr., Boston, for the Connecticut River organization. Mr. Burdett reviewed the peculiar features of the franchise granted the Transmission company by the Board of Aldermen of 1908, showing how the small power user was in reality not certain of securing service from the hydro-electric company unless acceptable to the latter, and at rates depending on such local conditions as might apply. Mr. Burdett argued that in the French King Rapids charter granted by the Legislature of 1908 the State had fixed its definite policy with regard to the sale of power in Fitchburg, units of not less than 300 hp being the clear intention for the water-power enterprise. Although under a different company, and developing a different site, the transmission pertinently should fall under the same regulations that applied to the French King company, for the interests are the same and so is the market. Previous legislation is limited, but it authorizes water-power companies to approach a market already served by a central station only after close limitations of the amount of power which shall be the minimum sold to any one consumer. The Fitchburg company welcomes the entrance of an organization into the field that will deal with large users exclusively under such terms as apply to the French King company. Although the ability of the company to supply primary power without the considerable use of steam auxiliaries has been questioned, the fundamental issue is whether the entry of the corporation into the community is in the public interest. Considerable misapprehension exists in Fitchburg as to the benefits the small consumer will derive from this power.

Mr. Burdett then said that a solution of the question would be for the Transmission company to sell the local company secondary power at a price which, supplemented by the service of the local company from its steam plant, will enable the Fitchburg company to sell and distribute at as low rates as could the Transmission company. The effect would be to cheapen the cost of the general output of the local company. If the commission and city will co-operate with the parties there is no reason why a settlement should not be made with advantage to all.

For the Transmission company, Mr. Smith argued that the sole question is: What will best promote the public interest? Manufacturing is the chief industry of Massachusetts, and local factories must compete with other parts of the country enjoying cheaper fuel, supplies and labor, less stringent regulations and closer proximity to raw materials. Low-priced hydro-electric power will encourage new development and better aid in the meeting of competition. The Transmission company can successfully occupy the field; its plant is 90 per cent completed and the field of supplying low-priced power to manufacturing interests on a large scale is practically unoccupied. There is no policy in the State prohibiting the introduction of low-priced power. There will be no permanent benefit to the public from the competition of two substantially similar electric light companies. The exclusion of this power would work serious injury. Public interest requires the admission of the Transmission company on some terms, and it is doubtful if the public interests will be best conserved by the entry of the Transmission company into the small-power business. A mutual agreement between the companies appears to be a fair way out of the problem.

For the commission, Chairman Barker then closed the hearings by stating that the board appreciated the more than local importance of the case as a precedent, and that a decision would be rendered at the earliest possible day.

Massachusetts Legislative Notes.

The committee on taxation has reported leave to withdraw on the Reynolds bill providing for the imposition of an excise tax on telephone and telegraph companies on the basis of the annual gross receipts of such corporations per mile of single wire operated by them in each town of the State.

Governor Draper has suggested that the Legislature appropriate $35,000, to be refunded by the New England Telephone & Telegraph Company, for further investigation of the cost of service and rates in Massachusetts by the Highway Commission.

The committee on public lighting has reported favorably on the bill to authorize the consolidation of the electrical business and property of a gas company with the business and property of an electric light company in the same or a contiguous municipality. The House has refused to discharge this bill from the orders of the day under suspension of the rules, but will consider it in regular course.

Senator Potter has introduced a bill into the Senate authorizing the Metropolitan Water and Sewage Board to permit the Connecticut River Transmission Company to erect and maintain power lines over certain lands of the State.

The Senate has accepted the report of the committee on taxation against the Dean bill for providing a so-called equitable taxation of public service corporations, and to permit cities and towns to levy and collect such taxes. The committee on mercantile affairs has reported leave to withdraw the Reidy bill prohibiting telegraph companies from changing the date lines of transferred telegrams. The same committee has also voted leave to withdraw the Abbott bill to make uniform telephone rates in the city of Boston. The committee on taxation has reported against the Dean bill taxing foreign telephone and telegraph companies.

CURRENT NEWS AND NOTES.

PEAT AS FUEL.—The U. S. Geological Survey, Washington, D. C., has printed for distribution a report by Messrs. E. S. Bastin and C. A. Davis on the peat deposits of Maine, which also treats generally of the nature, origin and utilization of peat.

ELECTRIC LIGHT FOR COUNTRY HOMES.—The engineering experiment station of the University of Illinois, Urbana, Ill., has issued a new edition of its bulletin by Mr. T. H. Armine, on "Lighting Country Homes by Private Electric Plants."

GOVERNMENT OWNERSHIP OF MEXICAN UTILITIES.—The Mexican Government is considering the advisability of obtaining financial control of all the public utilities in Mexico City and to operate the electric light and railway plants under a system similar to that of railroads comprising the Government merger system.

SMOKELESS COMBUSTION.—A bulletin on the smokeless combustion of coal in boiler plants, with a chapter on central heating plants, will soon be issued by the United States Geological Survey, Technologic Branch, Washington, D. C., giving in detail a study of the conditions found in industrial establishments in 13 of the largest cities of Indiana, Illinois, Kentucky, Maryland, Michigan, Misouri, New York, Ohio and Pennsylvania, between 400 and 500 plants having been inspected. Sufficient information was collected to make the data from 284 plants of value for this report. A copy of the bulletin, which was prepared by Messrs. D. T. Randall and H. W. Weeks, can be obtained upon application to the address above given.

FLORIDA STATE TELEPHONE ASSOCIATION.—The annual meeting of the Florida State Telephone Association will be held at Orlando, Fla., April 22 and 23.

FRENCH WIRELESS TELEPHONY.—Lieuts. Colin and Jeance, of the French navy, have invented a wireless telephone system by means of which conversation was recently successfully maintained between the Eiffel tower, Paris, and Melun, 30 miles distant.

INTERNATIONAL CONFERENCE ON PATENTS.—A committee of patent lawyers are urging the Secretary of State to arrange for an international conference for the discussion of patent laws, and particularly of discriminatory laws such as recently enacted in Great Britain.

PROPOSED IDAHO AND MONTANA HYDRO-ELECTRIC DEVELOPMENT.—The Northern Idaho & Montana Power Company, recently organized, will develop several water-powers on the Big Fork, Moyie and Pend d'Oreille rivers, the available horse-power of the falls controlled aggregating 100,000.

NO MUNICIPAL PLANT FOR KENOSHA, WIS.—Two years ago a municipal plant for Kenosha, Wis., was authorized by vote, but the City Council on April 5 awarded by a unanimous vote a five-year contract for public lighting to the Kenosha Electric Railway Company, thereby signifying that a city plant will not be established.

FLORIDA ELECTRICAL ASSOCIATION.—A meeting of central-station men will be held at Orlando, Fla., April 21, for the organization of a State electrical association. Mr. H. A. Grant, superintendent of the Orlando Light & Water Company, who is at the head of the movement, expects an attendance of 100 at the meeting.

N. E. L. A. EXHIBITION.—The exhibition to be held in connection with the National Electric Light Convention to be held at Atlantic City, June 1-4, promises to be one of the most successful in the history of the N. E. L. A. Five days after sending out a circular to prospective exhibitors 75 per cent of the space available was taken.

PUBLIC SERVICE COMMISSION BILL IN ILLINOIS LEGISLATURE.—There is a prospect that the Public Service Commission bill now pending in the Senate of the Illinois Legislature will be reported out of committee within the next two weeks. The bill, which was introduced by Senator Samuel A. Ettelson, of a Chicago district, was the subject of a notice last week in these pages.

EIGHTY-THOUSAND-VOLT WINNIPEG HYDRO-ELECTRIC PLANT.—Work has been commenced on the water-power development at Point du Bois for a 20,000-hp generating plant, the current to be transmitted to Winnipeg. The transmission line, the total length of which will be 75.5 miles, will be over a right-of-way 100 ft. wide. The total water-power available at Point du Bois is stated to be 60,000 hp.

ELECTRICAL FEATURES AT GARY TO BE DISCUSSED.—A joint meeting of the Electrical Section of the Western Society of Engineers and the Chicago branch of the American Institute of Electrical Engineers will be held at the Western Society's rooms, Chicago, on the evening of April 16. The speaker will be Mr. B. R. Shover, electrical engineer of the Indiana Steel Company, at Gary, Ind., who will discuss some of the electrical features of the new "Steel City" at Gary.

I. E. S., NEW ENGLAND SECTION.—The April meeting of the New England section of the Illuminating Engineering Society will be held in the auditorium of the Edison Building, 39 Boylston Street, at 7:30 p. m., April 20. Mr. S. R. Keyes, of the Boston Edison Laboratory, will read a paper on "Some Recent Tests on Street Lighting." The entertainment committee, of which Mr. E. C. Kimball, 39 Boylston Street, Boston, is chairman, will endeavor to provide some plan for the getting together of members for dinner before the section meeting. All who shall be in Boston that evening are requested to send their names to Mr. Kimball as soon as possible.

ILLUMINATING ENGINEERING SOCIETY.—A recent canvass of the membership of the Illuminating Engineering Society showed that 56 per cent of the members are connected with the electrical part of the industry, 22 per cent with the gas part, the remaining 22 per cent being oculists, architects, etc. A large increase in the percentage of gas men is expected during the present year. Although the place and date of the next annual convention have not yet been selected it is probable that the convention will be held in New York City early in the fall.

BOSTON NEWSPAPER WIRELESS PLANT.—The Boston *Herald* has signed contracts with the Stone Telephone & Telegraph Company for the installation of a wireless telegraph equipment for general news service on the tops of the newspaper's buildings on Tremont and Mason Streets. There will be an aerial 222 ft. long, 143 ft. above the ground at one end and 97 ft. above the street at the other terminus. A three-circuit type of receiver will be installed, and the detector will be of the Wollaston electrode type. Leads from the aerial will be joined together in a circuit running through the roof to the reportorial department in the *Herald* mechanical building. The object of the plant is to render the newspaper less dependent on unreliable wire telegraphic service.

ELECTRIC FIRE INSURANCE RISKS.—The Continental Insurance Company of New York has entered a protest against a resolution adopted March 16 by the Underwriters' Association of the Middle Department on the subject of electric risks. The resolution, which will come up for final action April 20, recites that as the concentration of financial control of electric railway properties and allied classes has produced conditions which threaten the gradual loss of the business to stock companies under present methods of control by the various underwriting associations, the association should relinquish jurisdiction over all rates and rules respecting the properties of electric railroad, electric power or gas illuminating companies, except risks the electric features of which are incidental and apart from the main purpose for which they are maintained and operated, or electric light or gas plants owned by municipalities.

CORRECTIONS.—In our issue for April 8, on page 868, in an article entitled "Estimating Monthly Demand from Experience" the dollar mark should not have been used over the last two columns in the table. As the heading indicates, the values in the table refer to the maximum number of 50-watt lamps that would be used simultaneously in commercial and residence districts. In the same issue, on page 876, the statement that the stator diameter would be increased 25 per cent, which appears in a letter by Mr. H. C. Specht, should read 2.5 per cent, which is the relative increase in the diameter of the stator of an induction motor provided with the self-contained auto-transformer starter described by Mr. E. J. Willis in our issue for March 25. The second equation, on page 732 of our issue for March 25, should read

$$L = y\frac{1+\frac{1}{6}\left(\frac{yW}{AT}\right)^2}{(1-kd)\left(1+\frac{T}{M}\right)}$$

instead of

$$L = y\frac{l+\frac{1}{6}\left(\frac{yW}{AT}\right)^2}{(l-kd)\left(l+\frac{T}{M}\right)}$$

as a reference to equation (1) on page 731 will show.

INDIANA MUNICIPAL LEAGUE.—The Indiana Municipal League will hold its next annual meeting at Lafayette, Ind., June 22, 23 and 24. Mr. Joseph T. McNary, of Logansport, Ind., is president of the league.

ELECTRICAL ACTIVITY IN DENVER.—The city electrician of Denver issued in March 535 electrical permits, an increase of almost 100 over the same month last year. During the month 907 inspections were made.

DAY SERVICE IN BATH, N. Y.—A sufficient number of contracts having been secured, the Bath (N. Y.) Electric & Gas Light Company announces that it will re-establish a day electric service for lights and motors, beginning May 1.

TEXAS A. I. E. E. BRANCH.—The students of the junior and senior classes of the electrical-engineering department of the A. & M. College of Texas have organized a student branch of the American Institute of Electrical Engineers under the direction of Prof. F. A. De Lay, head of the electrical engineering department. This is one of the strongest departments of the college.

BOSTON SIGNS NEW LIGHTING CONTRACT.—Mayor Hibbard, of Boston, has just signed a new five-year contract with the Edison Electric Illuminating Company for street lighting. The contract calls for the payment of $380,000 a year and may be extended by the city to a period of 10 years. If a 10-year contract is entered into the price is only $360,000 a year. A board of arbitration is provided which will consist of the scientific heads of Harvard and the Boston School of Technology, together with a third whom these two arbitrators will choose.

STEAM AND ELECTRIC RAILWAY FREIGHT EXCHANGES.—The Lackawanna, Grand Trunk, Ohio Central Dispatch and the Ontario & Western Railroads have agreed to prorate with the Toledo & Western, an electric line, on through rates and divisions on freight shipments that it originates. The arrangement goes into effect May 1 and is of exceptional interest and importance, owing to the previous unwillingness of steam roads to interchange freight traffic with electric roads.

BOSTON MEETING OF MECHANICAL ENGINEERS.—A meeting will be held in Boston on April 16 for the purpose of discussing a plan for holding in that city meetings of the American Society of Mechanical Engineers similar to those held in New York, for the reading and discussion of papers. Members of all Boston societies interested in mechanical engineering are invited to attend the meeting, at which President Jesse M. Smith and Secretary Calvin W. Rice, of the American Society of Mechanical Engineers, will be present, and also Mr. Willis E. Hall, chairman of the A. S. M. E. committee on meetings.

ELECTRICAL ENGINEERS IN PERU.—Consul-General Taylor, of Callao, Peru, reports that the only concern in Lima employing a foreign electrical engineer is the Empresas Electricas Asociadas, an American (Mr. Alfred L. Kenyon) being under contract at a high salary. Other electrical engineers are employed by the company, but are all subordinates at a salary of $75 per month, which seems to be the average paid electrical engineers. Many applications are received for these positions, especially from Americans and Germans, but Peruvians who have more or less mastered the art are generally given the preference over foreigners.

STORAGE-BATTERY LECTURE.—At a meeting held under the auspices of the Electric Storage Battery Company in Assembly Hall of the Case School of Applied Science, Cleveland, Ohio, on the evening of March 29, Mr. H. M. Beck, engineer of the operating department of the Electric Storage Battery Company, Chicago office, delivered a lecture giving in detail the development of the "Exide" battery up to its present state. After the lecture there was a general discussion of the subject which brought out useful information in relation to the care and operation of the storage battery. Various parts of the battery described were on exhibition for the inspection of the guests. About 250 were present at the meeting.

ELECTRIC DISPLAY AT BRIDGE CELEBRATION.—No definite plans have yet been completed by the Queensboro Celebration Committee for an electrical display at the formal opening of the Queensboro bridge on June 12. Quite a number of plans have been suggested to the committee, and it is said that within a week or 10 days some definite scheme will be adopted. The grandiose scheme suggested of spreading over one side of the bridge, from shore to shore, an electrical map of Long Island was never seriously considered, although announcements were published that it would be undertaken. It is probable, however, that the electrical display will be the most prominent feature of the opening celebration.

PENNSYLVANIA RAILROAD SIGNAL TRAINING SCHOOL.—The Pennsylvania Railroad has started a signal course of three years for the training of signal engineers. Upon graduation the men are eligible to appointment as assistant signal inspectors in the signal engineer's office. After attaining this they will be considered in line of appointment to the following positions: Assistant supervisor of signals, supervisor of signals, inspector, assistant signal engineer and signal engineer. The interlocking signal system of the Pennsylvania Railroad has increased threefold in the past six years. At present there are 12,408 signals in service, covering 3385 miles of road, or over 70 per cent of the entire mileage, and representing a value of more than $5,000,000.

ELECTRIC CLUB OF CHICAGO.—At the meeting of the Electric Club, of Chicago, on April 7, there was a general discussion of the subject of "Electric Heating Devices," opened by Mr. E. L. Callahan, and reported elsewhere in this issue. The matter of securing permanent quarters for the club was brought up in a brief report from the house committee, presented by Mr. Perry Boole in the absence of the chairman of the committee, Mr. W. R. Pinckard. The subject was briefly discussed, but it was decided that the time had not yet arrived for taking this important step, and the matter was therefore laid on the table. At the meeting of April 21 Mr. B. E. Sunny, president of the Chicago Telephone Company, who is not only a representative electrical man, but a public-spirited citizen as well, will address the club on the subject "Chicago Charter Bills." Mr. Sunny has devoted much attention to this subject, and owing to this fact and to his prominence in the industry a large attendance is anticipated.

PROPOSED RAILROAD ELECTRIFICATION IN ILLINOIS MUNICIPALITIES.—It is said that Mayor Busse, of Chicago, with the influence of the city administration, will favor an amendment to the cities and villages act of the Illinois statutes to provide that city governments may prescribe by ordinance the motive power by which cars or trains shall be operated within the limits of the municipalities and change the form of this motive power whenever, in their judgment, such change is necessary. Although the Illinois Central Railroad Company is committed to the eventual electrification of its terminal in Chicago, it is said that its plans are too vague and its progress too slow to suit the city government of Chicago, which hopes, therefore, to secure additional power to enforce its wishes. On the part of the city authorities it is pointed out that nothing more radical is proposed than the elevation of the railroad tracks in the city of Chicago—a work of great magnitude which has been successfully accomplished, or nearly accomplished. It is claimed that the city has the right to demand that all the railroads shall eventually electrify their lines within the city limits of Chicago.

The Havana Central Railroad.

By Reginald Gorham.

CUBA now possesses an up-to-date long-distance electric railway, which, moreover, is operated by a wide-awake company fully alive to the possibilities of the country. The Havana Central Railroad comprises two main lines, both with the same terminus in Havana, one of which runs in a southwesterly direction through the great pineapple and tobacco-producing districts to Guanajay, 31 miles distant, while the other serves an extensive grazing and fruit-growing land, in the center of which is the important town of Güines, although the actual terminus of the line is at a large sugar mill three miles beyond the town and 35 miles from Havana. A brief description of the two routes may be of interest.

On leaving the Arsenal Station, the trains skirt the bay for a short distance, leaving the ancient fortress of Atares on the right and the power house on the left, and soon pass the extensive workshops and car-sheds at Luyanó. At Underdown Junction the two lines branch apart, the Guanajay going to the right and passing through some of the most popular residential sections of the capital, notably Marianao, nine miles distant. Almost during the entire journey the train runs through land devoted to the cultivation of pineapples, which industry has attained to great proportions during the last few years, and largely owing to the exceptional facilities for transportation afforded by the company's special trains drawn by electric locomotives; 750,000 crates being shipped from the Havana Central wharf alone last year, as against 430,000 the previous season. A great deal of tobacco is grown in the part of Cuba traversed known as the "Buelta Abajo" and famous as producing the finest tobacco in the world. On reaching the terminus of the line, Guanajay, communication with important agricultural centers is afforded by the company's automobile service from that point.

The scenery on the Güines line, although not quite so interesting as that met with on the other route, is still beautiful, the royal palm being everywhere in evidence. The land seen in the first part of the journey is principally devoted to cattle raising. At Jamaica is situated a large stone quarry on the hillside, from which most of the material is obtained for building the government roads. Beyond San José, 20 miles from the start, the principal product of the soil is the sugar cane, the company making a specialty of transporting not only the cane but the sacks of sugar. Extra trains are run during the tourist season to enable visitors to visit the large mill of "Providencia," where the whole process of extracting the sugar from the raw cane can be observed.

FIG. 2.—INTERIOR OF GUINES SUBSTATION.

The engineering features of the system are decidedly interesting. The line is operated on the overhead trolley system, direct current being supplied at 600 volts. The system of distribution is high-tension, three-phase, the voltage on the transmission line being 19,000, which is transformed down and converted in six substations, three being situated at suitable points on each line.

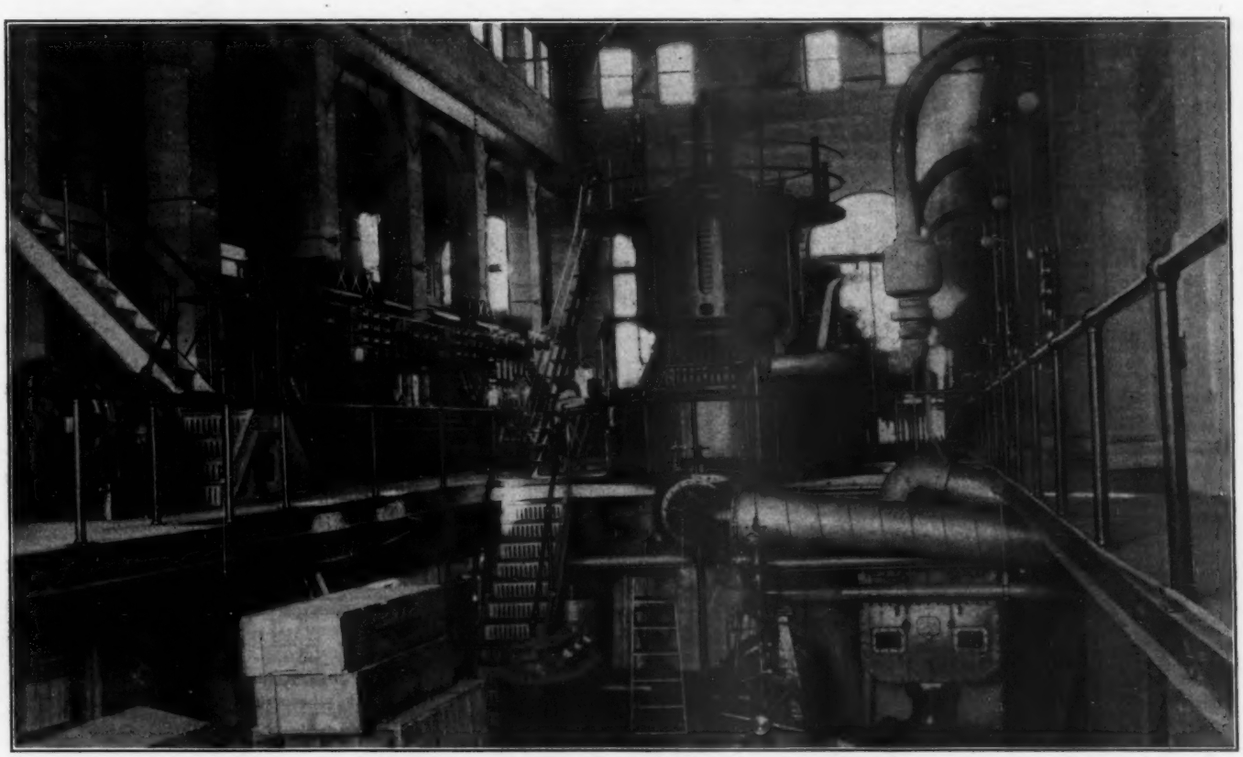


FIG. 1.—VIEW OF INTERIOR OF POWER HOUSE.

The power house is a fine example of modern electrical engineering practice and contains seven 750-hp Munoz boilers with chain-grate stokers. The engine room contains three vertical Curtis turbo-generators, made at Schenectady, N. Y., two being

of 2000 kw and one of 1000 kw. These machines generate current at 2200 volts, 25 cycles, which is transformed up to 19,000 volts for transmission. The exciting plant consists of one motor-driven set, 125 volts, 360 amp, running at 750 r.p.m., and one steam turbine set, 125 volts, 250 amp, running at 1600 r.p.m. The handsome black switchboard is 48 ft. long, and is arranged for remote control, the high-tension switches being placed on an upper gallery. Rotary converters are placed in all the substations, and there are three in the main power house. Motor-generators for lighting are also installed, as the company

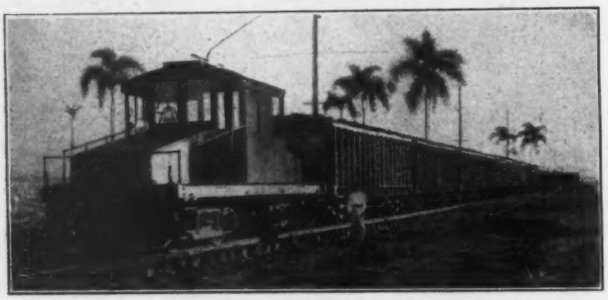


FIG. 3.—SUGAR-CANE TRAIN ON GUINES LINE.

supplies a great deal of current for town illumination and power work in various industrial establishments along the line of route. The track is rock-ballasted throughout, and is laid with rails weighing 75 lb. per yard.

There are 20 passenger motor cars and 10 trailers; they are 56 ft. long and hold 62 people, except a few which have a small compartment for baggage, whose seating capacity is 56. They were manufactured by the Wason Manufacturing Company, of Springfield, Mass., and are equipped with four General Elec-

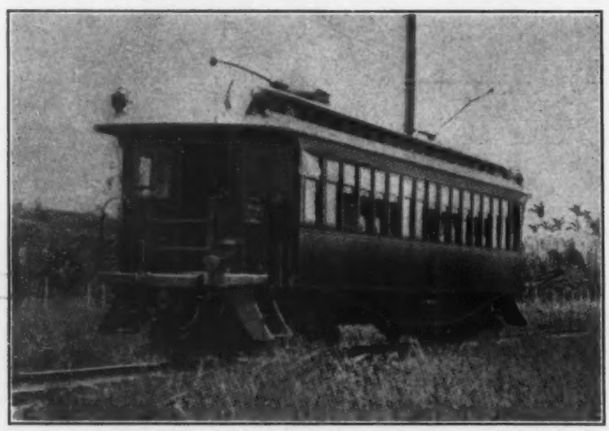


FIG. 4.—PASSENGER CAR ON GUINES LINE.

tric motors of 75 hp each. The trains, which are of two, three or four cars, are operated on the Sprague multiple-unit system. The locomotives, 10 in number, weigh 40 tons each, and are equipped with four General Electric motors of 90 hp each.

The line was constructed by the company, under the supervision of Mr. A. W. K. Billings, of Havana; it is now controlled by the United Railways of Havana, an English company, of which Mr. L. S. Diaz is vice-president and chief engineer, and Mr. W. S. Webster, assistant engineer.

Oak Forest (Ill.) Infirmary Power Plant.

Work is in progress under the direction of the Board of County Commissioners of Cook County on an infirmary for irresponsibles and dependents at Oak Forest, Ill., about 20 miles southwest of the center of Chicago on the Rock Island Railroad. About $2,000,000 will be expended on what is really a little settlement consisting of 25 buildings. The institution consists of various wards, hospitals, administration buildings, and the like, and will have its own railroad station. A prominent feature will be a power station supplying heat, light, power and water to all of the buildings in the group. All the structures are of brick and of fireproof construction. Nevertheless a complete system of fire protection is provided, with a standpipe in each building and a general water-tower 109 ft. high and 15 ft. in diameter with a capacity of 130,000 gal. Under the power house there will be an additional reservoir for water to be used if needed in case of fire. The water is obtained from deep wells.

The power house has ground dimensions of 102 ft. x 160 ft. and is 45 ft. high. It has a stack 190 ft. high, made of radial brick, and contains five 350-hp boilers equipped with automatic chain-grate stokers. There is also a complete equipment of coal- and ash-handling machinery, with a track scale and a coal crusher. The pumping equipment includes not only the pumps for the fire-protection service, but also those needed in the operation of the power house. A Gamewell fire-alarm system is installed, and all buildings are connected to it. In case of an alarm of fire the engineer starts up the high-pressure pumps and at the same time sounds an alarm on a steam whistle said to be sufficiently powerful to be heard for a distance of 10 miles, supplying a means of summoning outside help if necessary.

Three slow-speed simple Corliss engines in the power house will be direct-connected to 250-volt, direct-current Western Electric generators having respective ratings of 350 kw, 250 kw and 150 kw. A steam-driven refrigerating plant will be a part of the power-house equipment. A marble switchboard of 15 panels is equipped with ammeters, Thomson wattmeters and Westinghouse graphic instruments for amperes, watts and volts. Eleven sets of paper-insulated, lead-covered feeders will conduct electricity to the various buildings and points of distribution about the grounds. They are provided with extra-heavy lead armor. All wires, steam pipes and water mains are to be carried underground in reinforced concrete tunnels 5 ft. wide and about 7 ft. high. A complete intercommunicating telephone system of the Stromberg-Carlson type is provided for the use of the institution.

Electric light is used to illuminate the grounds and buildings. Eighty-five arc lamps will be needed in the power house and about the grounds; those for the latter purpose being set on ornamental iron posts, and about 10,000 16-cp incandescent lamps will be connected to the electrical circuits in the buildings. The three-wire system is used, and lamps and motors are supplied from the same mains. All interior wiring is in iron conduit. In the power house two separate sets of mains are provided for lighting. The lamps are connected on alternate mains, so that if a fuse should blow out in one circuit the plant would not be in darkness. The panel boards in the various buildings are of approved type with snap switches on each circuit and Edison plug fuses. The general lighting in the various buildings is controlled by flush push-button switches located at convenient points in the rooms.

About 30 electric motors, ranging from 2 hp to 30 hp in rating and aggregating about 300 hp will be needed to drive the pumping machinery, coal crusher in the power house, ventilating fans, woodworking machinery, laundry machinery, dough-mixer, ice-crusher, elevator, dumb-waiters and other machinery. In the laundry electricity will be used for heating flatirons, and in the ward buildings outlets for electric foot-warmers are provided at the head of each bed. To these outlets heating pads or other electrical appliances can be attached at the discretion of the nurse in charge. About 300 or 400 electric foot-warmers will be needed.

It is expected that the work on the grounds and buildings will be completed about Dec. 1, and that the institution, when fully equipped, will be able to care for 2000 inmates. Holabird & Roche, Chicago, are the architects for this little village, if such it may be called, and the Masterson Electric Construction Company, of Chicago, is the electrical contractor.

Gas-Producer Central Station at Harvard, Ill.

The Harvard Light & Power Company, of Harvard, Ill., has been operating its power plant with gas derived from a suction producer since Jan. 1, 1908. This company is a consolidation of the electric lighting interests in the town of Harvard, which has a population of from 4000 to 5000. In 1907 Messrs. W. H. Joyce, H. R. Page and E. J. Condon, of Chicago, purchased the worn-out municipal street-lighting plant and also the commercial lighting plant owned by the Smith Electric Company. How successful the Harvard venture in the municipal lighting field had been may be judged from the fact that the machinery, poles and wires were bought in by the new company for $1,425. The machinery was junk and the lines had to be almost entirely rebuilt. The old companies were purchased by the Harvard company in March, 1907.

A new two-story steel and brick building, 50 ft. x 50 ft., was built for the new producer-gas engine plant. The second story of the building, which has a reinforced concrete floor, is for coal storage and for the air and water tanks used in connection with operating the producers and engines. The first unit installed was a 250-hp, three-cylinder Weber gas engine direct-connected to a three-phase, 175-kw, 2300-volt Western Electric alternator. The engine runs at 200 r.p.m. It is supplied from two Weber producers, which are shown in Fig. 1. The engine is shown in Figs. 2 and 3. The company has under contract a second unit which is to consist of a 250-hp, vertical, four-cylinder Weber engine, running 225 r.p.m., to be direct-connected to a 175-kw, three-phase, 2300-volt Western Electric alternator. With the second unit will be installed a third producer.

The fuel used is buckwheat anthracite. This is unloaded from cars or wagons alongside the building and elevated by a motor-driven conveyor to the coal-storage bins on the second floor over the producers. From these bins it is let down by a pipe into the hoppers of the producers.

Compressed air for starting the gas engine is supplied by a small compressor driven by a gasoline engine. This gasoline

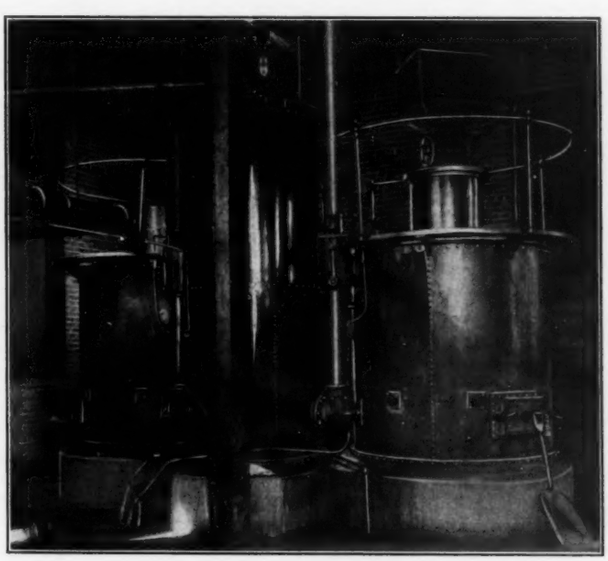


FIG. 1.—GAS PRODUCERS.

engine is also arranged to drive the fan blower which creates the suction necessary to start the producers before the gas engine is started. As the plant requires considerable water for circulating in the cooling jackets of the gas-engine cylinders and around the producers, the plant has its own deep well, from which water is drawn by a motor-driven pump. Water-storage tanks are on the second floor. The amount of water required in a 14-hour run is about 250,000 gal., or about 18,000 gal. per hour. Provisions are being made to discharge into a cement pool outside the building, cooled and used over again.

The plant is not provided with recording watt-hour meters so that the coal consumption per kw-hour is not known. At present writing night service only is given. For a 14-hour run during the heavy load in December the coal consumption was about 2700 lb. per night. Buckwheat anthracite coal costs in Harvard about $4.60 per ton. The consumption for a night's

FIG. 2.—GAS-ENGINE UNIT.

run in March averaged about 2400 lb. From this it will be seen that the fuel cost is undoubtedly much lower than for a steam plant of similar size with coal from $2 to $3 per ton. The peak load in March was about 78 kv-amp.

In the regular operation of the plant one man is sufficient. He starts to blow up the fire in the producer from 30 to 45 minutes before starting time, this being done by starting a little gasoline engine which drives the blower. This blower sucks the air through the fire in the producer just as does the gas engine after the plant is started. After the fire has been blown up so as to produce a good quality of gas as tested by igniting the gas at an outlet near the fan blower, compressed air is turned on one of the cylinders of the engine and it is started. The engine creates a suction which in a few revolutions draws producer gas into the engine so that it begins regular operation on gas. While the fire is being blown up some of the ashes are worked off the grate and from around the sides of the producer so as to leave a clean fire. The fires are worked every two hours, alternately, on the two producers. The engineer's chief duty, aside from oiling and feeding coal into the producer magazines from the bins above, is to maintain the quality of the producer gas uniform by noting the behavior of the engine and varying the air and moisture supply in accordance with experience. The producer must at all times be maintained at about a uniform condition as regards cleanliness from ashes and freedom from pockets of ashes in the fire.

The amount of vapor or moisture introduced in the producer influences the richness of the gas, and this vapor supply must be watched by the attendant carefully. Where a man understands it there is apparently considerably less actual manual labor in the operation of the producer-gas plant of a given capacity than for the operation of a steam plant of the same capacity.

Since the quality of gas as it is made from second to second in the producer directly affects the operation of the engine, the operation of the plant is especially susceptible to improper manipulation of the producer and to the condition of the fires. For this reason the two producers in this plant are ordinarily operated together so that a temporary variation in quality of

gas from one producer will affect only part of the gas being produced and delivered to the engine. Fires are never worked in both producers at the same time during operation.

The reliability of the gas-producer plant as compared with a steam plant is a point upon which there has been the most question. The experience of this company, which seems to correspond with that of other companies, is that the producer gas-engine combination is as reliable as a steam plant after the operators have fully learned how to handle the apparatus. During the first four months, however, there was considerable trouble.

For three months previous to the present writing the company reports only one accidental shutdown, and that was due to the breaking of a spring on the gas engine and not to anything about the producer. The troubles which were first experienced with the plant were apparently due almost entirely to the fact that men familiar with producer and gas-engine operation are scarce and there is no good supply of such men to draw upon. Both the officers of the company and the men under them had to depend very largely upon learning by experience before reliable operation was secured.

The pole lines over the town have been rebuilt and new Fort Wayne transformers and meters installed. An office, storeroom and shop are maintained on the main street, where a window display is made, a stock of supplies is kept and meters are tested. The company supplies the city with 41 standard 6.6-amp enclosed alternating-current arc lamps. A 50-light Western Electric arc transformer and regulator supplies this service.

The service and rates have been such an improvement on the

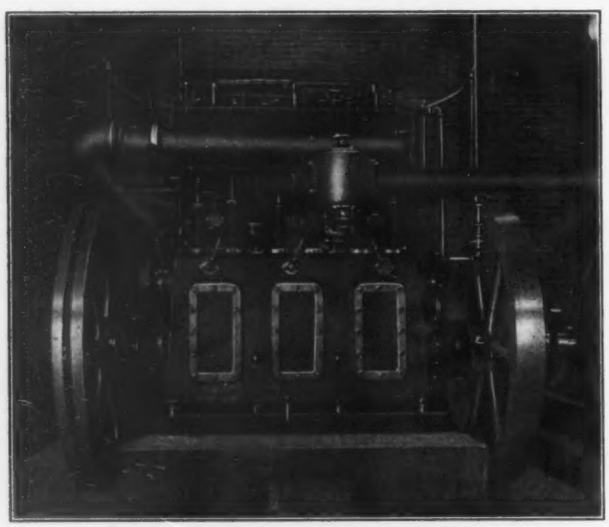


FIG. 3.—GAS ENGINE.

old electric lighting conditions in Harvard that the lighting business increased a trifle over 100 per cent during the year 1908. Mr. E. J. Condon, president of the company, estimates that even now there is only about 25 per cent of the possible business connected up. There were 68 private gasoline lighting plants in the town when the present company took hold. This number has been reduced to 24. Good, reliable service and the tungsten lamp have been the chief instruments in effecting this reduction. The company solicits business by advertising in the local papers, by letter writing and by personal solicitation. The rates have been reduced three times since this company took hold. As they now stand they are 14 cents per kw-hour for 50 kw-hours per month or less. The discounts are according to quantity, which brings the rate down to 10 cents for over 200 kw-hours per month.

The officers of the Harvard Light & Power Company are: W. H. Joyce, secretary and treasurer, and E. J. Condon, president and manager, Unity Building, Chicago. C. C. Condon was superintendent of construction.

The Performance of a Synchronous Commutator.

By J. B. Whitehead and L. O. Grondahl.

THIS paper is an account of a series of experiments on a rectifying device consisting of a synchronously rotating commutator supplied, through collector rings, with alternating e.m.fs. The single-phase arrangement of this type delivers a pulsating e.m.f., commutates poorly and has received only a limited application in certain types of self-excited alternators. If, however, the commutator is suitably connected and is fed with a polyphase system of e.m.fs., the continuous e.m.f. may be made as uniform as desired, and commutation becomes a question of the angle of lead of the brushes, and the constancy of the frequency. The arrangement adopted in the experiments is described in United States patents Nos. 547,683 and 628,358, granted to Henry A. Rowland in 1895. Hutin and Leblanc[1] have also described a similar device, and several other modifications of the principle have been suggested.[2] Rowland's idea was never embodied in a device, and no account of performance is given by Hutin and Leblanc other than a statement of satisfactory operation.

The so-called "permutator" of Zipernowski and Deri and the "panchahuteur" of Hutin and Leblanc are kindred in principle, but differ essentially from the arrangement mentioned in that they employ a rotating magnetic field to induce the system of polyphase e.m.fs. in a stationary armature with the usual type of distributed winding connected to the commutator. These machines require an elaborate system of compensating coils for damping higher harmonic e.m.fs. which result from the toothed construction of the magnetic circuit. The brushes revolve synchronously and the operation is thus subject to disturbances from variations of frequency. Excellent account is given of the performance of these machines, several of which are in present service.

THEORY.

If n e.m.fs. of a symmetrical n-phase system of frequency N be connected in series, the resultant e.m.f. is zero at every instant.

$$\sum_{k=0}^{k=n-1} E \sin\left(B - \frac{2k\pi}{n}\right) = 0; \; B = 2\pi N t \qquad (1)$$

It follows that when such a system is connected in series to form a closed circuit no current exists. The maxima of the e.m.fs. between successive pairs of opposite points on this closed circuit will follow each other around the circuit as they do in a two-pole closed-circuit armature winding. Hence, between two opposite points of the circuit there will be developed a single-phase e.m.f. of frequency N. The value of this e.m.f. at any instant is

$$\sum_{k=0}^{k=\frac{n-2}{2}} E \sin\left(B - \frac{2k\pi}{n}\right), \text{ where } B = 2\pi N t. \qquad (2)$$

If there are n connections from the n junctions of the e.m.fs. the maximum e.m.f. travels from one pair of leads at opposite ends of a diameter, to the next pair and thus rotates with the frequency of the n-phase system. These leads may be taken to an equal number of commutator segments, and brushes which rotate synchronously on such a commutator will collect direct current. The continuous e.m.f. has the value

$$\sum_{k=0}^{k=\frac{n-2}{2}} E \sin\left(B - \frac{2k\pi}{n}\right) \qquad (3)$$

[1] *La Lumière Elec.*, Vol. 47, 1893, p. 51.
[2] Arnold and La Cour, "Wechselstromtechnik," B. IV, p. 817.

all values of the sine being considered positive because negative parts of the wave are reversed with reference to the brushes by the method of connection. As B varies from O to $2\pi/n$, from $2\pi/n$ to $4\pi/n$, etc., the value of the continuous e.m.f. passes from a minimum to a maximum and back again to a minimum. The smaller the number of phases, the greater the value of $2\pi/n$ and hence the greater the fluctuations. Since there is one maximum for every $2\pi/n$th part of a cycle, there are as many direct-current maxima per cycle as there are phases. As the number of phases is increased, the difference between the maxima and the minima is decreased and it is possible to obtain direct current as uniform as may be desired by increasing the number of phases. The difference between maximum and minimum when 12 phases are used is about 3.5 per cent; for 24 phases it decreases to less than 1 per cent.

Any number (n) of phases of e.m.f. may be obtained from a quarter-phase system by the proper distribution of coils on two transformer cores. Moreover, all of these may be connected in series, and leads from their junction points may be connected to the segments of a synchronously driven commutator. Commutation may then be accomplished at various loads in identically the same manner as in a direct-current generator —that is, by shifting the brushes forward to such an extent that the short-circuited coil has induced in it the e.m.f. necessary to reverse the current. Commutation at constant load and frequency should be as perfect as it is in the direct-current generator.

The short-circuiting of a coil by the brushes affects the wave-forms of the continuous e.m.f. and of the transformer flux. The e.m.f. is lowered slightly by the fact that for the period under the brush one coil is short-circuited and those between this coil and the position of commutation at no-load are reversed. The transformer flux is also sharply reduced by the current in the short-circuited turns if the period of short-circuit is too long. These conditions may not be sufficient to have a prohibitive effect on either the primary or the secondary currents; when they are sufficient they can be lessened by increasing the number of phases, because by increasing the number of phases the e.m.f. per phase producing current in the short-circuited coil is also diminished.

The only irregularities that can occur in the wave of flux oscillating in the uniform and independent magnetic circuits of the transformers are those of low value due to hysteresis and those due to short-circuit at commutation. The latter may be diminished by finding the proper length of time for short-circuit and by increasing the number of phases. Such an arrangement if operable would, therefore, avoid the use of the compensating winding of the panchahuteur, and would be simpler and less expensive. These characteristics are possessed by the simpler arrangement of Rowland and that of Hutin and Leblanc. Each of them requires only a small rotating part and low driving power. The only losses are in the transformers and in the two sets of brushes. The regulation and efficiency of such a machine should, therefore, be good.

APPARATUS.

The energy available for the experiments was obtained at 220 volts, two-phase and 60 cycles. The smaller the number of phases, the greater the voltage between commutation segments and the greater the consequent short-circuit current in the coil under the brush. In a 12-phase system the fluctuations in the continuous voltage are very pronounced, as already indicated, and by adopting 12 phases and 60 cycles it would appear as though very rigorous conditions of performance were imposed. Sixty cycles requires a much shorter period of commutation and either greater speed or a larger commutator with a greater number of segments than does 25 cycles. It was, therefore, decided to transform the available 60-cycle quarter-phase into 12-phase, and investigate the performance of commutation to direct currents.

The apparatus was constructed for the transformation of 5 kw from 200 volts quarter-phase to 110 volts continuous. This arrangement involved two transformers, each of 2.5-kw rating with secondaries suitably interconnected to give a symmetrical 12-phase system of e.m.fs. of proper value. They were of the core type with a wire space 14 in. long on each leg. The cross-section was cruciform and had an area of 10 sq. in. The induction was chosen in the neighborhood of 4000 lines per centimeter. This arrangement gives as a convenient number of primary turns to form the proper ratios 288, with 0.695 volt per turn. In deducing the number of secondary turns necessary it is to be noted that the effective e.m.f. on the brushes is obtained by their following the maximum of the secondary alternating e.m.f. around the closed circuit as in the converter. If in the general expression for the total e.m.f. between any two opposite points in the closed secondary winding:

$$k = \frac{n-2}{2}$$

$$\sum_{k=O} E \sin\left(B - \frac{2k\pi}{n}\right) \qquad (4)$$

there be substituted the values of k and n for 12 phases, there is obtained for the instant $t = O$ $E_{dc} = E\left(\sin\frac{\pi}{6} + \sin\frac{\pi}{3} + \sin\frac{\pi}{2} + \sin\frac{2\pi}{3} + \sin\frac{5\pi}{6}\right) = 3.73\,E$. This value is the minimum of E_{dc} and its variation is about 3.5 per cent. Taking the minimum value of the continuous e.m.f. as 110 volts the maximum value of the e.m.f. per phase of the 12-phase secondary system is 29.5 volts. The average value of E_{dc} is 3.82 E or about 112.7 volts.

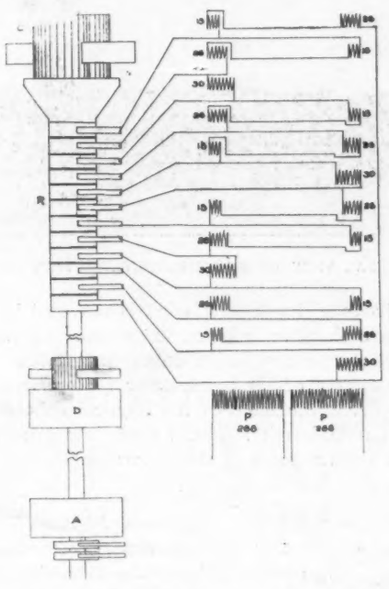


FIG. 1.—INTERCONNECTIONS TO COMMUTATOR.

The method of determining the number of turns on each transformer for the successive phases is well known.[9] In the present case the several phases were formed from independent windings. The secondary turns on each transformer for each phase are as follows:

Phase.	Turns on No. 1.	Turns on No. 2.
1	30	0
2	26	15
3	15	26
4	0	30
5	—15	26
6	—26	15
7	—30	0
8	—26	—15
9	—15	—26
10	0	—30
11	15	—26
12	26	—15

The coils containing 26 turns have about 0.1 per cent too many. The negative sign indicates that the coils are connected

[9] Steinmetz, "Alternating Current Phenomena," Chapter XXXVI.

in the reverse direction. These pairs of coils are connected in series, as indicated in Fig. 1, and between successive pairs 12 leads are taken to an equal number of brushes and collector rings. The coils are so arranged that the two legs on a transformer always have the same number of ampere-turns similarly arranged, and the primary is wound in two layers on each leg with 72 turns per layer. As calculated, the copper loss per transformer is 2.74 per cent, the iron loss 2.6 per cent, the full-load efficiency 94.7 per cent.

Each collector ring is connected to four equidistant bars in a 48-part commutator. This number of segments for the commutator was chosen so as to reduce the speed to that of an available eight-pole, single-phase synchronous motor. To this motor there was directly coupled a direct-current generator which could also be used as a starting motor. The eight-pole motor makes one-fourth of a revolution for each cycle, which fact necessitates four times as many commutator segments as

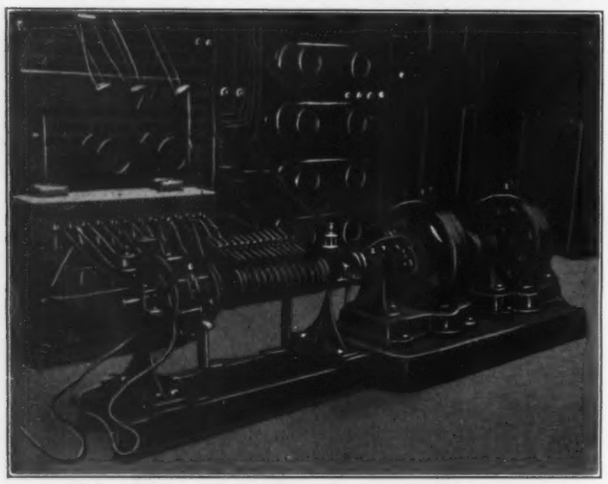


FIG. 2.—GENERAL VIEW OF SYNCHRONOUSLY-DRIVEN COMMUTATOR.

there are phases. The direct current is collected by eight carbon brushes, each ⅜ in. x ⅞ in. in section. The commutator is 6 in. in diameter and has a collecting surface 4 in. wide. With the exception of the commutator the entire construction was carried out in the shops of the Physical Laboratory of the Johns Hopkins University. Fig. 2 shows the general arrangement of the several parts of the apparatus.

PERFORMANCE.

The rotating part is brought up to speed by the direct-current machine used as a motor, and the single-phase motor is then synchronized. When running in synchronism the transformer primary circuits may be closed and the proper position of commutation may then be found by adjusting the brushes for minimum sparking. On loading the direct-current side, the brush position for sparkless commutation shifts forward. The amount of the brush shift is practically proportional to the amount of direct-current output, and from no-load to full-load is about 4 deg. of arc, or about 0.2 in. on the commutator. A low value for this quantity is objectionable as it renders commutation sensitive to dissymmetries of commutator construction and relative spacing of brushes, and also to oscillations of the rotating part about the position of true synchronism. In the present apparatus the low value is due to the small number of phases. It was also found that the width of six commutation segments taken at various portions of the circumference varied as much as 1/16 in. The frequency variation was sometimes as great as 3 per cent. In spite of these facts, the operation at constant load for any value up to full load was very satisfactory. At 25 per cent overload the sparking would prevent continuous service. In this region the required variation of the brush lead is less than the variations in the symmetry of the apparatus. In the region of one-half load, variations of about one-third full-load are possible with fixed brushes.

REGULATION AND EFFICIENCY.

Data of regulation and efficiency were obtained for the transformers with the rotating part of the machine and also for the transformers alone. The readings are given in Table I.

The change in the continuous e.m.f. from full-load to no-load was from 110.0 to 122.7 volts, 12.7 volts, or 9.7 per cent. In the transformers alone the rise was from 86.5 to 88.5 volts, 2 volts, or 2.26 per cent (Fig. 3). The efficiency of the transformers at full-load was found experimentally to equal 94.0 per cent. The calculated value given above is 94.7 per cent. This must be considered very fair agreement, and indicates that there are no abnormal losses in the magnetic or copper circuits and that the balance of e.m.fs. in the closed secondary circuit is nearly perfect. The loss in the brushes and rotating part increases with the load and varies from 2.5 per cent at 4 amp direct current to 8.0 per cent at 41.2 amp, or full load.

The single-phase secondary e.m.f. given in equation (2) may also be written

$$E_{ac} = \frac{E}{\sin\frac{\pi}{n}} \sin\left(B - \frac{n-2\pi}{2n}\right)$$

The continuous e.m.f. is given by the same expression if, as before, all values of the sine are considered positive. This

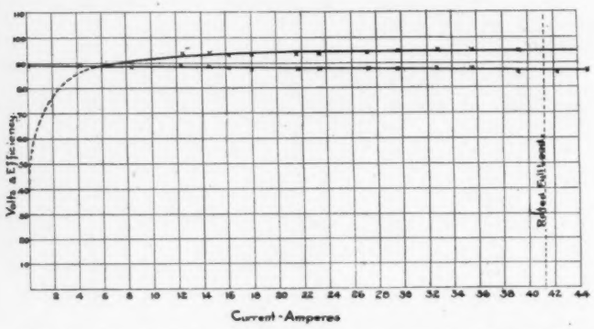


FIG. 3.—REGULATION AND EFFICIENCY OF THE TRANSFORMERS.

means that the continuous e.m.f. is made up of a series of crests of sine waves. The sine is a maximum for $B - \frac{n-2}{2n}\pi = \frac{\pi}{2}$, or $B = \pi - \frac{\pi}{n}$. For this value of B, $E_{ac} = 3.86E$. This is then also the maximum value of the continuous e.m.f. The minimum evidently occurs at $B = \pi$ and is $3.73E$. The average value of a sine wave between $\frac{\pi}{2}$ and $\frac{\pi}{2} + \frac{\pi}{12} = 0.993$ times the maximum value $= 3.83E$. This is the average value of E_{dc}. The output of the transformers is, therefore, taken as the product of the effective value of the single-phase e.m.f. and the direct current, multiplied by $0.993\sqrt{2}$. This is the value used in Table I, column 9.

TABLE I.

Input.			Output.				Volts		Eff.	Per cent loss in
Volts.	Amp.	Kw.	Volts.	Amp.	Kw.	Eff.	trans.	Kw.	trans.	brushes.
112.6	"	"	125.5	0	0	0	127.3	0	0	0
112.2	1.37	.600	123.8	4.1	.507	84.5	127.2	.522	87.0	2.5
112.0	2.67	1.195	122.0	8.4	1.024	85.9	126.1	1.060	88.8	2.9
111.5	3.78	1.686	120.1	12.43	1.498	88.9	125.7	1.562	92.7	3.8
111.5	4.42	1.971	119.5	14.67	1.752	89.0	125.4	1.840	93.4	4.4
112.2	4.93	2.213	119.0	16.28	1.938	87.6	125.8	2.047	92.3	4.7
110.8	5.44	2.410	117.1	17.98	2.105	87.5	124.1	2.234	92.7	5.2
111.1	6.50	2.886	117.1	21.50	2.517	87.1	124.1	2.670	92.5	5.4
110.1	6.95	3.086	115.2	23.35	2.690	87.2	122.8	2.867	92.9	5.7
110.3	8.10	3.567	114.2	27.22	3.112	87.3	122.3	3.333	93.5	6.2
109.9	8.70	3.821	113.3	29.60	3.355	87.7	122.0	3.612	94.5	6.8
109.6	9.63	4.220	112.6	32.7	3.680	87.3	121.7	3.979	94.4	7.1
109.4	10.53	4.615	110.0	35.7	3.961	86.1	121.6	4.340	94.2	7.9
109.2	11.63	5.070	110.5	39.3	4.340	85.7	120.7	4.740	93.6	7.9
109.2	12.80	5.590	109.7	42.3	4.640	83.0	120.2	5.085	91.1	8.3

The first column of Table I gives one-half the value of the primary voltage. The second column gives the current in one phase of the primary. The input given in column 3 is then determined as four times the product of this current and the voltage given in column 1. To test the accuracy of this method

the input was measured also by means of a wattmeter that had previously been calibrated in terms of the other instruments. The results agreed to within the limit of experimental error—for example, volt-amperes = 0.525 and wattmeter reading = 0.529 kw. The next three columns give voltage, current and the power output on the direct-current side. The total efficiency of transformation given in column 7 is then the ratio of output to input as given in columns 6 and 3. Columns 8 and 9 give the voltage at the transformer secondaries, and their output is obtained as described above. The efficiency of the transformers, given in column 10, is the ratio of the output as obtained to the input. The per cent loss in the brushes and the rotating part was taken as the difference between the total efficiency of conversion and that of the transformers. With increasing load the efficiency of the transformers increases, that of the rotating part decreases, and more rapidly, so that a combination of the two forms a curve with a maximum of 89 per cent at 14 amp direct current—one-third load (see Fig. 4).

With driving power included (0.35 kw = 7 per cent), the total efficiency of the apparatus varies from 74 per cent at 0.1 load to 79 per cent at full-load. As indicated below, the loss in the direct-current brushes at full-load is about 6 per cent, more than half of which may be attributed to mechanical imperfections. The power for driving a commutator and collector rings capable of delivering 500 kw at 500 volts should not exceed 10 kw, or 2 per cent. With apparatus of this larger rating, therefore, and remembering the higher efficiency of the larger transformers, it is probable that efficiency values in the neighborhood of 90 per cent would be obtainable.

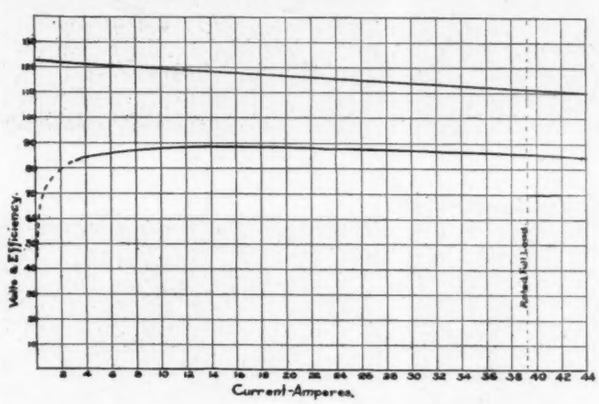


FIG. 4.—REGULATION AND EFFICIENCY PRIMARY OF TRANSFORMERS TO DIRECT-CURRENT BRUSHES, DRIVING POWER NOT INCLUDED.

The drop in the voltage in the carbon brushes and contact with the commutator was measured for various values of output. The results are given in Table II. At full-load the drop at this point is about 6 per cent. The values of ohms per square inch, given in the last column, are uniformly more than twice as great as those readily obtainable in direct-current generators. The excess is due in large measure to mechanical vibration and other structural imperfections, and the consequent slight chattering of the brushes.

TABLE II.

Voltmeter readings.	Current.	Volt-amperes.	Contact resistance of four brushes in ohms.	Ohms per sq. in.
1.2	4.2	5.1	.286	.220
1.7	8.6	14.6	.196	.151
2.3	12.6	29.0	.183	.141
2.5	16.5	41.2	.152	.117
2.7	24.4	63.5	.111	.085
2.8	28.1	78.6	.100	.076
3.2	31.9	102.0	.100	.076
3.4	34.6	117.6	.098	.075
3.4	37.4	127.1	.091	.070
3.4	41.0	138.6	.083	.064
3.5	43.6	152.3	.078	.060

In the set of curves, Fig. 5, No. 1 is the percentage drop in the voltage in the transformers proper; No. 2 that due to the shift of the brushes, and No. 3 that due to the resistance of the brushes and to the contact resistance between the carbon brushes and the commutator. No. 4 represents the total drop in voltage. The drop due to the brush shift is observed experimentally by placing on the commutator two search brushes, one in the position of commutation at no-load, the other following the carbon brush.

COMMUTATION.

For constant direct-current output the performance is entirely satisfactory. Such an apparatus would receive limited application, however, unless capable of handling varying loads without attention. Owing to the conditions under which the present apparatus was constructed it is certain that the widest possible variation of load with fixed brushes was not reached. Yet within the rated full-load output, variations of one-third full-load with fixed brushes were handled without serious sparking. Shifting the brushes forward brings the short-circuited coil into a position in which it receives a reversal e.m.f. The value of this e.m.f. does not change with the output, however, and it is constant for a given position of the brushes. The above-mentioned variations of load were made with the brushes shifted ahead of the exact no-load position.

Automatic assistance to commutation may be provided in several obvious ways. A series of experiments was performed to ascertain what is possible in the way of an automatic arrangement either to accomplish the brush shift or to make commutation possible for all values of load, the brushes being fixed in one position. Obviously retarding the rotating part will have the same effect on the relative position of the brushes and commutation as advancing the brushes. This may be accomplished in several different ways. The following methods were tried for effecting commutation at all loads with the brushes in fixed position:

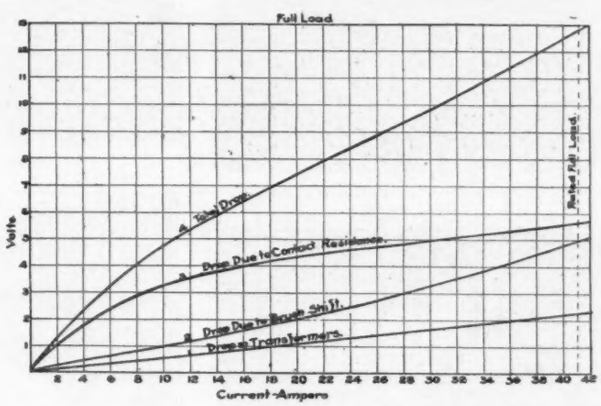


FIG. 5.—DISTRIBUTION OF TOTAL DROP IN ELECTROMOTIVE FORCE.

1. Retarding the rotating part.
   (a) By mechanical braking actuated by output current.
   (b) By loading the direct-current generator.
   (c) By variation of the field of the synchronous motor.
   (d) By varying the phase of the e.m.f. applied to the synchronous motor.
   (e) By varying the position in space of the resultant motor field.
2. Leaving angular position of rotating part fixed.
   (a) By collecting the direct current by means of split brushes with reactance coils between the halves.
   (b) By inducing an e.m.f. in the n-phase leads by means of commutating poles.

In applying the several methods of retarding the rotating part no attempt was made to construct the actuating mechanism by which the several influences may be made to vary with the amount of direct-current output. Automatic means of applying methods (c), (d) and (e) would offer no difficulty, and the principal aim of the experiments was a determination of the available influence which may be brought into play.

Methods 1 (a) and 1 (b) retard the rotating part by increasing the load on the motor. They thus consume power; they

were tried only for the purpose of determining whether automatic commutation is feasible by any method causing the necessary change in the angular relation of the armature and the field pole. Both methods worked admirably, no difficulty being found in adjusting the friction or generator loads for commutation of all loads within the rating of the apparatus.

In method 1 (c) it is suggested to take advantage of the distortion of the weakened field of a synchronous motor by armature reaction, and the consequent angular displacement of the armature. The motor as used was run at its normal impressed e.m.f., but at one-half its normal speed, thus necessitating a highly saturated field. For this reason attempts to apply this method were not found successful. Method 1 (d) was tried as follows:

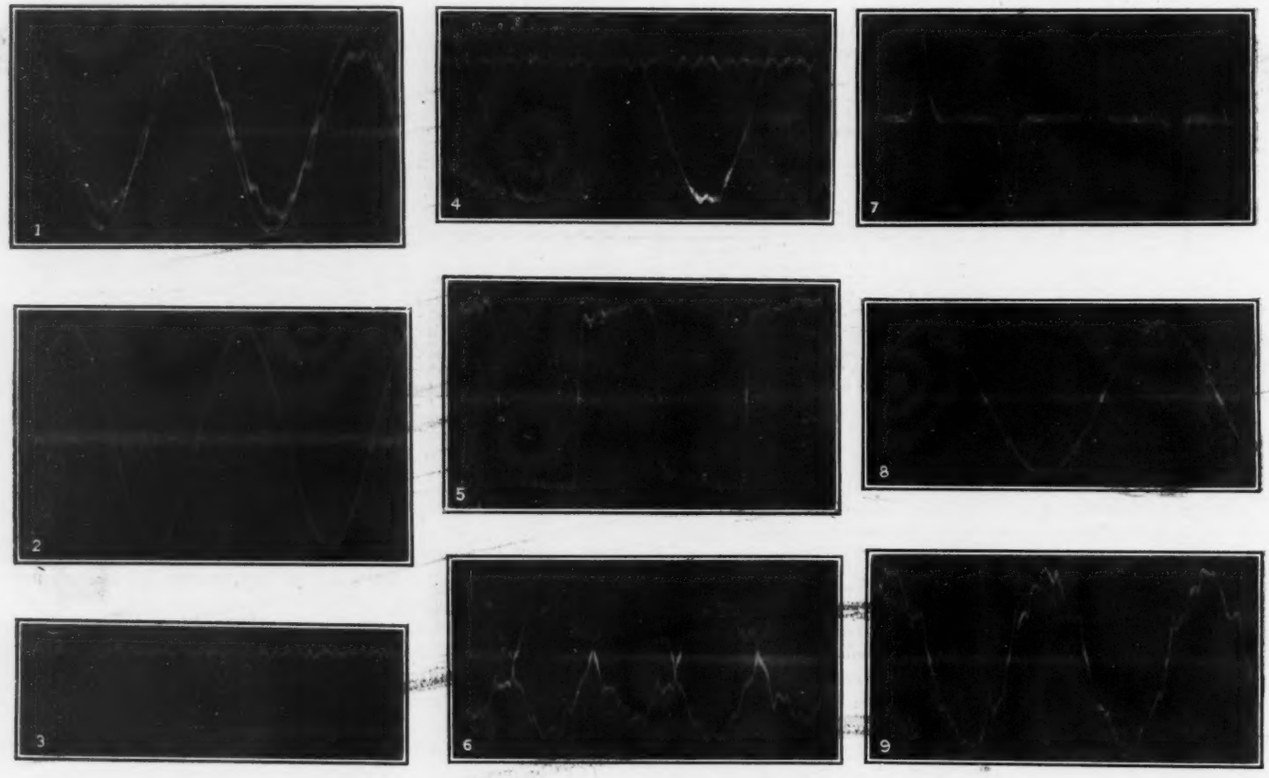
By inserting in the motor armature circuit a second variable e.m.f. differing in phase by 90 deg., a combination of the two will give any desired change in the phase of the impressed e.m.f. and a consequent change in the angular position of the rotating part. The motor received energy from one phase of the quarter-phase supply system. A transformer, the primary of which was excited from the other phase, had its secondary with a variable number of turns in series with the motor armature. The change in phase was then obtained by varying the number of turns included from the secondary. Any desired change can be obtained. Table III gives one series of readings showing the angular shift resulting from different values of voltage impressed from the second phase. Adjustment for any value of the load was possible by this method. A change from no-load to 30 amp, with the accompanying insertion of voltage, resulted in considerable hunting and sparking, lasting, however, for only a few seconds.

The change in angular position of the rotating part may probably be best accomplished through method 1 (e), that is, by means of auxiliary field-poles, excited by the direct-current output. By this means the resultant magnetic field may be made to shift in such a way that for any value of the load the armature will be in the proper place for commutation. This result can readily be obtained by automatically adjusting the size, scale and position of the auxiliary pole and the number of turns on it. This method was not tried.

Method 2 (a) was tried with several combinations of split brush with resistance and reactance. No improvement over the conditions with solid brushes could be noted; the same brush lead was necessary and an oscillograph record showed that it had no evident effect on the distortion of transformer flux.

TABLE III.

Voltage.	Shift, degree.	Direct-current load.
0	0	0
.5	.4	4.5
1.2	.7	7.5
2.6	.8	8.5
3.7	1.1	11.5
4.6	1.0	11.0
5.7	1.1	11.5
6.6	1.4	14.5
8.8	1.6	16.5
10.7	1.7	17.5
12.6	1.9	19.7
14.4	2.1	21.5
16.6	2.3	23.5
18.8	2.3	23.5
20.9	2.4	24.7
23.0	2.4	24.7
24.9	3.1	30.7



FIGS. 6 TO 14.—OSCILLOGRAPHS.

As the load increases so does the counter e.m.f. required to reverse the current in the coil that is commutated. If this e.m.f. could be introduced from some external source, the usual brush shift would not be necessary. This result may be accomplished by means of commutating poles. A pair of such poles excited by the direct-current output were rotated synchronously in proper relation to a series of coils, one in each of the 12 phases. Several modifications were tried without any promising results. The limitations of space on the revolving element prevented a thorough investigation of this method, which is apparently a possible one.

WAVE FORMS.

With a view to obtaining a more intimate knowledge of the performance and to studying the influence of the number of phases on commutation, a number of oscillographs of the

various alternating-current and direct-current quantities were taken. Some of these are shown in the accompanying figures:

No. 1, transformer primary impressed e.m.f. and current at full-load; No. 2, alternating e.m.f. between two opposite points of the closed circuit of the 12 secondary phases, at no-load; No. 3, continuous e.m.f. at no-load; No. 4, continuous e.m.f. and resultant secondary e.m.f. at opposite points of closed circuit, full-load; No. 5, current in closed transformer secondary circuit at full load; No. 6, transformer primary current and primary counter e.m.f. at full load; No. 7, current in one collector ring; No. 8, primary counter e.m.f. at no-load; No. 9, primary counter e.m.f. full-load.

The irregularities of the curve of primary current, as shown in oscillograms Nos. 1 and 6—the smoother curve—are seen to be the same as the number of phases in the secondary system. They are caused primarily by the succession of sharp changes in the number of secondary amp-turns. The secondary current has an approximately constant positive and negative value equal to one-half the continuous current. The number of secondary turns on each transformer, however, passes through a cycle of values during each alternating cycle, as may be understood from Fig. 1. Superimposed on this effect are those due to the period of short-circuit of a phase-winding by the direct-current brushes, and to the shifting forward of the brushes.

The effects of short-circuit by the brushes on the resultant alternating secondary e.m.f. may be seen in oscillogram No. 4.

The effect of the fluctuating continuous current on the transformer secondary current is seen in oscillogram No. 5.

The primary counter e.m.f. at no-load should be a smooth curve. The oscillogram for this counter e.m.f. as taken from a test coil on one core is shown as No. 8. The small kinks in this curve indicate the unsymmetrical spacing of the commutator segments. The contact between the brush and the segment does not occur at a uniform time-displacement throughout the cycle.

The primary counter e.m.f. at full-load is badly distorted; the principal cause is the fact that when the brushes are shifted forward a portion of the secondary turns are carrying a reversed current, thereby causing a sharp change in the value of the magnetic induction. In addition, there are the effects of the irregular resultant of secondary and primary amp-turns, and of short-circuit in the coil under the brush. The magnetizing component of the primary current is, therefore, also distorted. The effect on the total primary current is not great, however—see oscillogram No. 6—since the power component corresponding to the secondary output greatly exceeds the magnetizing component.

CONCLUSIONS.

The performance of the experimental apparatus indicates that the commercial possibilities of the principle are greater than have generally been supposed. The distortion of the primary current with as few as 12 phases is not prohibitive. The current distortion and conditions of commutation would be further improved at lower frequency by the use of a greater number of phases in the secondary system. The rotating element should have a small amount of inertia so as to follow quickly all possible changes of frequency. Commutation is satisfactory at constant load. Automatic adjustment of the conditions of commutation is possible, although sharp changes of load or frequency will be accompanied by more or less serious sparking of short duration. With increasing number of phases the cost and weight would be lessened and the performance would be improved by keeping the commutator fixed and rotating the brushes.

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MANAGEMENT, POLICIES AND COMMERCIAL METHODS

"Human Interest" in Central-Station Work.

The first (April) issue of *The Edison Round Table,* published in Chicago by the Commonwealth Edison Branch of the National Electric Light Association, has made its appearance, and it amply justifies the forecast of it recently appearing in these columns, being a bright and attractive illustrated magazine of 28 pages. Mr. R. F. Schuchardt, the editor, and his associates are entitled to congratulations. One interesting feature in "The Oracle" department is a forecast of the station equipment necessary for the company's business in 1920. The present generating equipment is about 150,000 kw, and the estimates for 1920 range from 500,000 kw to 1,500,000 kw. The latter estimate was made by Mr. W. L. Abbott, who has staked a dinner on the accuracy of his prediction.

A Diplomatic Complaint.

A central station in one of the Central States recently received a communication from a customer, a lawyer, which read as follows:

"Herewith enclosed I hand you check for $4.72 in payment of my electric light account with you. Your men were here the other day to test my meter, and possibly their test will have disclosed to you that this meter has been developing a wonderful burst of speed. With no evening work, with my office closed the latter part of the day a considerable portion of the time this winter, with only three electric lamps ever lighted, my little meter up in the dark closet has worked faithfully for you and apparently annihilated twice as many kilowatts as the meter I had last winter could do with six lights working full time. This is not meant in a spirit of complaint, but I feel that in a monopoly such as yours ability of such a high order should not be overlooked, and that the sphere of usefulness of my little meter to your concern should be enlarged. I will be perfectly satisfied with a less ambitious one, and if you will only place the other where the number of lamps used are considerably in excess of mine, I am sure the exchange will be satisfactory to you from the dividend-paying standpoint."

Flatiron Advertisements.

The Pacific Electric Heating Company, Ontario, Cal., has instituted a comprehensive advertising campaign to further the introduction of electric heating apparatus. *Collier's Weekly* of April 10 contains a full-page announcement relating to electric flatirons, and similar space will be taken in *Everybody's, Munsey's,* the *Century* and *McClure's.* A circular has been sent to central stations and supply dealers on the Slope advising the addition of local color to this national campaign by advertising in local papers, the circular being accompanied with copy for advertisements and an offer to supply cuts. It is suggested that if newspapers are not used, the advertisements be mounted on a piece of cardboard and displayed in the window, or a window display made beginning April 8 or 9 and lasting several days, calling attention to the fact that the dealer has the electric flatiron that is being advertised in *Collier's Weekly* and the leading magazines. An expert ironer from a laundry using one of the irons in a nicely decorated window is also advised, or the placing of a little bench in the window and having an employee of the repair department to work there, taking apart the iron and showing how it is made, and then showing how quickly the iron heats up and how it retains its heat. Burnt impressions with the iron may also be made on heavy blotting paper or heavy tag board. An offer is made of a full supply of printed matter to all interested in the sale and use of the iron.

Some Lessons on Meter Complaints from Paris, Ill.

The City Gas & Electric Company, of Paris, Ill., of which Mr. William T. Clark is manager, recently went through an experience a knowledge of which may be helpful to many central-station companies where meter complaints are plentiful. One of the newspapers of Paris began a systematic campaign against the accuracy of the company's meters and left no stone unturned to create a feeling of dissatisfaction and suspicion among consumers. As a result of this agitation the City Council appropriated $300 to engage Mr. Edward E. Winters, of New York, as consulting engineer, to test meters submitted by complaining customers, and in view of the charges that had been made against the company about inaccurate meters, the company was only too glad to have such an investigation started. The Council investigating committee scoured the town for complaining customers, both gas and electric, and advertised in the papers for them. The complaints did not come in very rapidly, but finally the committee succeeded in getting 27 electric consumers to say that they were not satisfied with the registration of the meters on their premises.

Mr. Winters carried on his tests with an indicating wattmeter, checked by a precision wattmeter at the University of Illinois. The meters were tested in place on the consumers' premises. The results were about as would be expected by anyone having a knowledge of the general characteristics of electric meters. Of the 27 meters tested only four were found fast under light or heavy load. Of these four fast meters two were fast on light load and two on heavy load. Of the 23 which were found slow the inaccuracy ranged all the way from 80 per cent down. The most inaccurate of the fast meters was 4.22 per cent fast on heavy load and 7.11 per cent slow on light load. This investigation, of course, effectually discredited all the talk about meters being fast.

The company has a method of testing meters in the presence of consumers when complaints are made that differs from the methods commonly used by other companies. Instead of testing the meter on the consumer's premises by turning on and off lamps of known consumption and showing him that the registration is about what would be expected from the rating of the lamps, the meter is brought into the company's office and placed in circuit with a Thomson portable testing meter. The manager then takes up the matter personally with the consumer in the office and the meter is tested in comparison with the portable testing meter.

Mr. Clark says that this proves more satisfactory and convincing to the consumer than a test with lamps, though general experience is to the contrary. The company handles its gas-meter business the same way, bringing gas meters in to test with a prover in which the number of cubic feet of gas is measured directly in a small gas holder. Meters complained of are brought in for test because it is easier and takes less time for the manager to take up these matters with the consumer at the office than to visit the premises.

Boiler-Room Routine of Rockford Electric Company.

The Rockford Electric Company, at its main power plant in Rockford, under the management of Mr. F. H. Golding, has inaugurated a system of operation in the boiler-room which is intended to hold up boiler load factors and keep boilers operated at best economy. The plant contains 3150 rated horse-power in nine boilers of 350 hp each. These boilers, as here illustrated, are equipped with Jones underfeed stokers. In the main boiler feed-pipe is inserted a Venturi meter. This meter indicates the rate of flow in number of pounds of water passing per hour on a large dial and also records it on a recording chart. This is in plain view in the boiler-room, where is can be easily seen at any time by the fireman and water-tender. The rule is established that the number of boilers in operation must be kept small enough so that the water used per boiler per hour is not below 12,300 lb. The normal rating of the boiler using 30 lb. per hp-hour demands 10,500 lb. per hour, so that it is expected that the boilers will be worked always at considerably above their rated load. The 12,300 lb. is the minimum limit, so that there are times when a boiler is evaporating considerably more than this. For example, if four boilers were in operation, a fifth would not be cut in until the rate of water consumption arrived at a point where the cutting-in of the fifth

BOILER ROOM, ROCKFORD ELECTRIC COMPANY.

boiler would not lower the rate below 12,300 lb. per boiler per hour.

The water-tender is directly responsible for the feeding of water to boilers, the number of boilers in use and the control of the air supply. The water-tender on each shift reports to the chief boiler-man, who is assistant to the chief engineer. The chief boiler-man takes the records of the Venturi water meter each day and compares them with the kw-hour output.

There is a Sarco CO_2 recorder in the boiler-room which automatically makes seven registrations of per cent of carbon dioxide per hour. This is connected to different boilers on different days, and as the average conditions on all boilers are kept uniform, the firemen are governed by the indications from the boilers to which the instrument is connected in operating the remaining boilers in service at that time. There is considerable rivalry between the different shifts of firemen to maintain a good record. The company is burning coal from the Southern Illinois field and the percentage of CO_2 runs from 10 to 11, which is considered the best record obtainable with this kind of coal.

The firemen work three shifts. There are three firemen on two of the shifts and four firemen on the third shift, with one ash-man and two boiler-cleaners and repair men.

The water required per kw-hour in this plant averages about 35 lb. for all-day operation. These boilers supply a mixed equipment of slow-speed compound-condensing engines and 500-kw steam turbines with barometric condensers.

Low-Voltage Tungsten Sign Lamps in Denver.

As is generally known, the Denver Gas & Electric Company, under the direction of Mr. H. L. Doherty, makes extensive use of sign lighting and outdoor illumination. It not only supplies a great deal of energy for this purpose to its customers, but makes a profuse use of this form of advertising to advance its own business. Its office building, situated at the corner of

Seventeenth and Tremont Streets, is made striking at night by the use of attractive decorative lighting without and display lighting within. About 600 lamps are studded in arches between the first and second floors of the building and also in a line of cornice lights above, serving to illuminate the exterior. A large roof sign is used for public notices of various kinds, and a further feature is an arch over Seventeenth Street carrying several hundred incandescent lamps. The general appearance at night of the company's office building is shown in the accompanying illustration (Fig. 2).

Recently the company has effected a great saving in energy by using tungsten lamps for the small arches and the cornice lighting. Both the new lamps and the old ones are rated at 5 cp, but the old carbon lamps consume 20 watts each and the new tungsten lamps only 5 watts each. This results in a saving, at the lamp, of 75 per cent in energy, and nearly all the energy so saved can be usefully applied to other sign lighting on flat rates. Bryan-Marsh lamps are used in the new tungsten

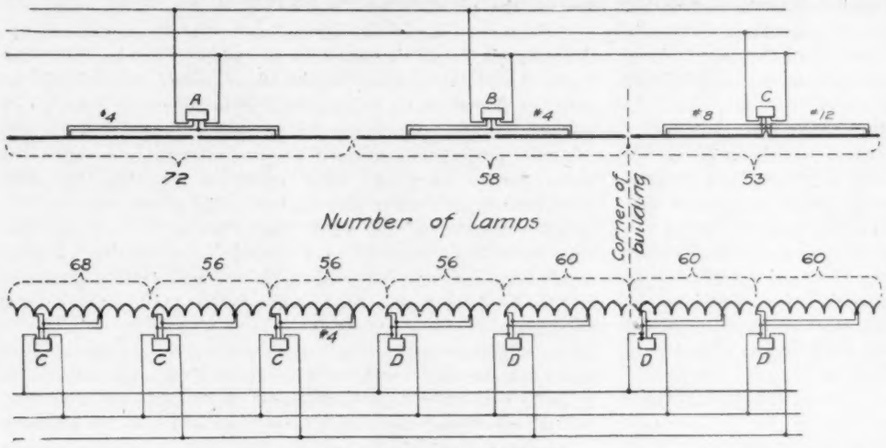


FIG. 1.—WIRING DIAGRAM.

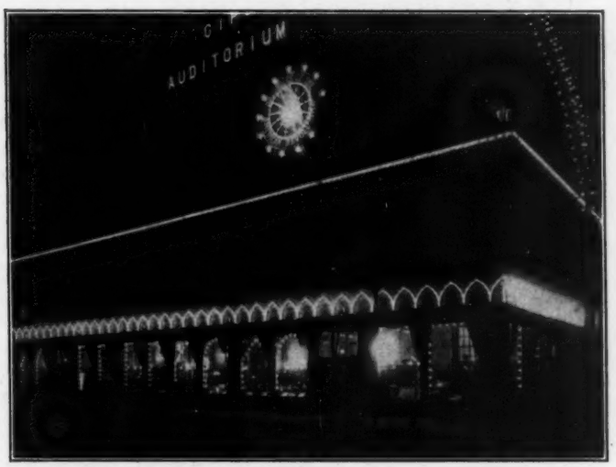


FIG. 2.—EXTERIOR LIGHTING WITH TUNGSTEN LAMPS.

installation. There are 416 lamps in the arches and 183 in the cornice. They were operated in the original installation at 108 volts from alternating-current, 60-cycle mains.

In order to use the small tungsten sign lamps it was necessary to reduce the voltage at the lamps in a ratio of 10 to 1, and to supply this low-voltage energy at a number of points on the lighting circuits in order to keep the distribution loss and drop as small as possible. This required the use of a number of small transformers, and low-voltage transformers made by the Enterprise Electric Company, of Warren, Ohio, and the Kuhlman Electric Company, Elkhart, Ind., are used. Eight ¼-kw, step-down, 108-volt transformers, having a 10-to-1 ratio at full load, were ordered for the arches, and two 1/3-kw, 216-volt transformers, having a 10-to-1 ratio and an additional tap giving 20-to-1 ratio at full lead, were ordered for the cornice. In Fig. 1 *A* and *B* are 1/3-kw, 216-volt auto-transformers, 10-to-1 ratio, with 20-to-1 tap. *C* and *D* are ¼-kw, 108-volt transformers with 10-to-1 ratio. The circuits are fused on the primary side. The signs are wired with No. 12 wire.

From the layout of the lighting circuits it was found advisable to use but seven of the ¼-kw transformers on the arches. The eighth, as well as the two 1/3-kw transformers, was placed on the roof. This arrangement balanced the load on the various transformers fairly well. The sign itself was wired with No. 12 wire, which was not sufficiently large to carry the energy required with permissible drop, and this necessitated the use of No. 4 feeders tapped in as shown in the accompanying wiring diagram (Fig. 1). The transformers which feed the lamps on the arches are placed at about every seventh arch and mounted directly on the building. They are quite inconspicuous. It was found that the total variation in voltage on the low-voltage circuits was about 10 per cent, but this produced no noticeable difference in the candle-power or color of the lamps. The transformer efficiency is about 92 per cent. The average consumption, figured from the service switch, was about 7.05 watts per lamp, including transformer and line losses, but without taking into account the power factor.

During the progress of the installation the sign was at one time illuminated partly by carbon lamps and partly by tungsten lamps. In this situation the quantity of light given out by the two kinds of lamps was not noticeably different, but the contrast between the white of the tungsten and the yellow of the carbon lamps was striking. Directly in front of the tungsten lamps the effect was not quite so good, due to their low end-on candle-power, but from a slight angle the tungsten lamps make a fine appearance.

Taking all factors into consideration, the consumption of electricity is reduced to about one-third the former amount by this change. The general appearance of the arches and cornice has been improved, and the only thing which yet remains to be demonstrated by actual experience is the relative renewal cost of these lamps compared to the old carbon lamps. It is believed that the useful life of both types of lamps is about the same—that is, about 2000 hours.

Electric Heating Discussed at Chicago Club.

"Electric Heating Devices" was the subject discussed at the weekly luncheon of the Electric Club, of Chicago, on April 7. Mr. E. L. Callahan, of the General Electric Company, was the principal speaker. He made an earnest plea for the co-operation of all engaged in the electrical industries in "boosting" the heating branch of the business. During the last five years there has been a great change in the attitude of the public toward electric heating. It is now an important branch of the industry, and 15 concerns or more are making electric-heating apparatus. The possibilities of electric heating and cooking add to the attractiveness of electric service, and houses should be wired so that all forms of electrical conveniences may be installed. The desirability of foresight of this character should be impressed upon architects. Central-station companies should advocate electric heating because it makes use of the generating capacity and distribution systems of their stations at times when they are lightly loaded.

Mr. Callahan discussed briefly the varied character of the

devices used for electric heating, beginning with lamp-socket devices, which are particularly attractive to the consumer because no additional wiring is required. Then there are power-circuit devices, which should commend themselves particularly to central-station companies. The industrial field for electric heating introduces another class of devices. Here the possibilities are very great, and they have only begun to be appreciated. There is also a commercial use for electric heating. For instance, all boxes, barrels and cases shipped by manufacturers and dealers must be marked in some way. Why is it not entirely feasible to do this marking by means of electric branding irons? The fireless cooker promises to extend greatly the field of electric cooking in the household by bringing the cost within the means of persons in moderate circumstances. Already firmly established, electric heating is sure to be very widely extended in the future, and many devices not yet conceived will be used in its application.

Mr. F. J. Holmes, president of the Vulcan Electric Heating Company, of Chicago, pointed out that, particularly in the industrial applications, electric heating is not only very convenient, but actually results in a saving in operating cost. He spoke particularly of the electric soldering iron, and cited the case of a lantern factory where a good saving was made over the old gasoline torch, at the same time increasing the quantity and quality of the output. He also spoke of curling-irons in hair-dressing establishments, and said that in many industrial applications the saving that can be effected by the use of electric heat is really surprising.

Mr. Leonard Kebler, president of the Ward Leonard Electric Company, of Bronxville, N. Y., laid stress on the reliability of present-day electric heating devices. He said that the tools and appliances of this description which are now available have practically an indefinite life. This great point of reliability achieved, the manufacturers are now giving particular attention to securing greater economy in operating cost.

Mr. Harold Almert, of Chicago, lately manager of the Wichita (Kansas) Gas, Electric Light & Power Company, discussed the subject from the viewpoint of the central-station man. He said that in Wichita, where natural gas is available at 27 cents per 1000 ft., it was naturally a pretty difficult proposition to introduce electric heating and cooking. Nevertheless, the modern method is so convenient and attractive that there will always be found many users who will prefer it even if the cost be somewhat greater. Thus, the question of introducing these devices rests largely with the sales organization. It is of great importance to get the devices out among the public, and it is quite essential to find the right way of marketing them. Mr. Almert related some of his experiences in Wichita in this direction and pointed out that heating devices are especially valuable in increasing the demand from customers already connected and at the same time improving the load factor of the station.

Mr. George B. Johnson, of the Commonwealth Edison Company, Chicago, was called on and briefly referred to the remarkable flatiron campaign, under his direction, by which his company put out 10,000 electric flatirons between Dec. 15, 1908, and March 15, 1909. This achievement was briefly outlined in the issue of April 8. Mr. Johnson also made the interesting statement that the Commonwealth Edison Company has heating appliances, with a total rating of 18,000 kw, connected to its system. He remarked that the company had had success in putting devices of this character out on trial.

The last speaker was Mr. H. F. Holland, of the Pacific Electric Heating Company, of Chicago, who referred briefly to the advantages of the electric flatiron.

Holyoke's Municipal Lighting Finances.

By Glenn Marston.

Holyoke, Mass., has owned its municipal lighting plant for six years and has reduced the rates for gas and electric light several times during that period. Meanwhile the tax rate has advanced from $16 to $17.40. A small proportion of the increase, 43 cents, is due to the increased State tax, but the remainder appears from the official records to be due entirely to the increased financial burden imposed upon the city by the purchase of the lighting plants.

There is no city which has been so persistently held up as an example of the success of municipal ownership in the United States as Holyoke. It is managed by one of the most efficient operating men in the country, Mr. W. H. Snow, who has tried in every way to keep politics out of the management of the property, with the result that the service is excellent and the rates are low. An inquiry into these rates, however, shows that they are far from sufficient to meet the legitimate charges against the plant.

If the accounting of the lighting plants was conducted on even the same basis as the accounts of another municipal department, the Holyoke water works, there would be a deficit instead of the surplus of $54,930.90, as is shown on page 76 of the annual report for 1907. An example of the peculiar methods of reporting expenditures is that relating to bonds. The above surplus is shown after operating expenses, including bond interest, are taken care of, but in the whole report of the lighting department the word "bonds" does not appear. One must turn from page 76 to a folded insert bearing no page number, 256 pages further along in the municipal register, to find the city's appropriation for the payment of gas and electric bonds.

One would be inclined to call this deceptive accounting if it were not for the emphatic assurance of several officials in Holyoke that there was no intention to deceive; but it is difficult to understand why such a huge expenditure as the payment of maturing bonds, which are, of course, a direct charge against the plants, should be omitted—not even mentioned in any way—from the report. While the Mayor of Holyoke, in answer to an inquiry regarding the profits of the plant, stated that the plants showed a profit of $54,930.90, he afterward amended the statement by saying that the profits were $16,517.61. This admission shows that the Mayor himself must have been misled by the lighting department's report, for it is hard to believe that he would be a party to wilful deception in this regard.

It is difficult to understand why the city water works is compelled to pay taxes while the lighting department does not. If there is justice in making the water department pay its share toward the maintenance of the city government, and there manifestly is, why is the lighting department favored? Can it be the discrimination is due to the fact that the Mayor's profit of $16,517.61 (reduced from $54,930.90) would be wiped out and supplanted by a deficit? The taxes on the lighting plants, figured on the same basis as those of the water department, would be over $19,000. These taxes would, of course, be paid if the plants were owned by a private company. Apparently it is to avoid a deficit that the lighting department is not taxed.

From these figures it is evident that there would be a loss on the plant if even the charges recognized by other departments of the same city were made against the plant. No account is taken of the absurdly inadequate depreciation figures. The city auditor's own figures, incidentally, show an income for the lighting department of $323,706.18, while he shows expenditures and appropriations amounting to $356,319.84. This does not tally well with the reported profit of over $54,000. It will be noticed that there is a slight discrepancy between the income report of the auditor and that made by the lighting department. This is because the municipal year does not correspond with the 12 months covered by the lighting report.

The question of depreciation is always a difficult one—it is necessarily a matter of guesswork to some extent—but in the case of Holyoke there can be no doubt that the depreciation account is far too small. An allowance of 3 per cent is made for depreciation, while the officials themselves admit that all of the original electric plant left after six years consists of the waterwheels and one old-style Edison dynamo. A depreciation of 3 per cent assumes that the plant will last over 30 years. If practically all of it has been scrapped in six years, the depreciation rate should be nearly five times what it is. Depreciation

on the gas works has been by no means as rapid, but it is safe to assume that it has been considerably in excess of 5 per cent. Assuming 5 per cent for the gas plant and 15 per cent for the electric plant, the depreciation account would be something like $100,000 instead of $29,275.23. This one item alone would eat up a good deal more than the reported profit of over $54,000.

The annual report for 1908 shows that the profits have been materially reduced because of a reduction in rates made effective a year ago. While the "profit" for 1908 is only $30,965.57, the report again ignores the question of bonds, although additional bonds were issued during the year for "renewals and extensions," constituting an official admission that the depreciation account does not cover the actual wear and tear on the plant. This brings the annual appropriation for bonds up to $41,100. The report says: "At the station, extensive additions and alterations have been in progress during the year . . . $160,000 was appropriated to the department for this work and the wisdom of the move has already been shown." Not one word to the effect that this appropriation was made from the proceeds of additional bond sales. The only intimation that the department has anything to do with bonds is an item of bond premiums mentioned once on page 9 and once on page 12. Regardless of the additional burden placed upon the taxpayers by the bonds issued last year, the report calmly states that it makes a profit of over $30,000. The deficit this year must be even larger than it was last year, as the report omits all items that were formerly omitted, while the reported "profit" is considerably smaller, yet there is no indication that the existing state of affairs will be remedied.

It is easy to see why Holyoke is enjoying low rates for electricity and reasonable rates for gas when the city continues to issue more and more bonds to meet depreciation and construction that could be taken care of by the huge "profits" of the plant if these profits really existed. When a plant pays no taxes, has no sinking fund, and relies on the generosity of the taxpayers for the greater part of its depreciation account it would be strange, indeed, if good management—and Mr. Snow is a good manager—could not show a profit. The relatively small proportion of the population using gas and electricity appears to benefit by low rates, but in the meantime taxes are going up, and the annual appropriation from the city treasury for the payment of gas and electric bonds is increasing.

The New York Edison Company and Its Relation to the Electric Automobile Business.

By Norman G. Meade.

In New York city freight and delivery transportation has been a serious problem, but with the advent of electric commercial vehicles a great many difficulties have been overcome. The same characteristics apply to these conveyances as are found in all other systems of electric propulsion. Nothing can be easier to understand than the power plant of an electric wagon. There is no complication of parts, no delicate mechanism to wear out rapidly or to get out of adjustment and require an expert to make necessary repairs.

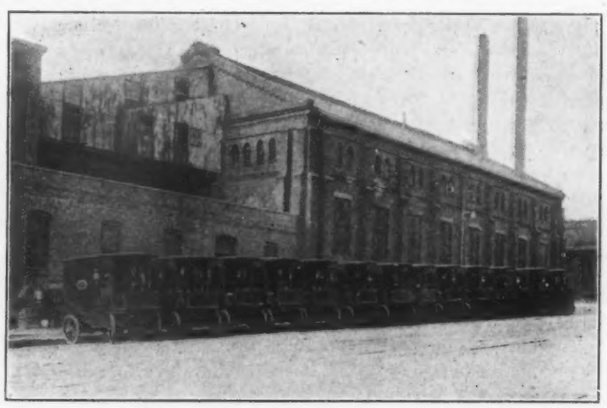
Many classes of delivery service involve long-distance runs with intermittent stops, while many more call for a large number of short trips. In either case it is generally unwise to wait for the regular delivery system with its scheduled routes and slow service. The frequency of sudden and unexpected demands often warrants the adoption by a commercial firm of a special-delivery equipment that will always be ready to make prompt deliveries at the request of customers.

The New York Edison Company was one of the first central-station companies to appreciate and take advantage of electric vehicles, and it has not only strongly recommended their use for pleasure and business purposes, but it is now one of the largest users of electric wagons and trucks in this city. The company maintains 12 passenger conveyances, 36 delivery wagons, three 2½-ton and 3-ton trucks, and five 5-ton trucks. The garage is located at Forty-first Street and First Avenue, where a complete repair shop and all the necessary facilities for overhauling and repairing batteries and vehicles—in fact, everything that goes to make up an entire automobile establishment—is found. A small garage is also maintained at 546 Pearl Street for light repairing and charging.

Thirteen of the electric delivery wagons are used for the incandescent-lamp delivery service. Lamp renewals are made by these wagons on requests from customers who write or telephone for them. These orders are routed by a night clerk who assigns about 60 orders to each wagon. In addition to serving lamps upon request, the lamp wagons call periodically every two or three months on every customer using incandescent lamps.

For the accommodation of electric vehicle users the New York Edison Company has established 20 charging stations in various parts of the city, where batteries can be recharged at a nominal rate of 10 cents per kw-hour. An order, signed by the owner or the chaffeur, and showing the meter readings before and after charging, filled in by the operator at the station, is forwarded to the general offices of the company. This arrangement is a great convenience to automobilists who are at some distance from a garage, as they can recharge without wasting time in a return trip for that purpose.

Through the columns of *The Edison Monthly* and advertising literature the New York Edison Company will illustrate and



LOADED LAMP WAGONS AT FORTY-FIRST STREET STOREHOUSE.

describe various types of electric automobiles and accessories and give general suggestions for economical and convenient operation and maintenance. The automobile engineer of the company endeavors to enlist the co-operation of various automobile companies to increase the sale and use of electric automobiles, and personally solicits large business houses using horse-drawn wagons to introduce the electric machines. In addition the engineer visits those already using "electrics" to ascertain if they are giving satisfaction. It is often found that through misapprehension much more current for charging is used than is necessary, or that the vehicles are not handled as economically as is possible. These difficulties the engineer tries to adjust to the satisfaction of the customer.

There are many large users of automobiles in New York on the Edison service. The New York Transportation Company alone has in operation 250 electric taxicabs. The Adams Express Company uses 55 1-ton and 2-ton trucks, and there are a number of other companies using many commercial vehicles driven by electricity.

The New York Edison Company has a regular automobile and storage-battery contract under which energy is sold at 6 cents per kw-hour, subject to a discount of ½ cent per kw-hour for a monthly consumption of 3000 kw-hours, up to 3 cents per kw-hour for a monthly consumption of 50,000 kw-hours. This contract is subject to the restriction that energy shall not be

used without the written consent of the company between the hours of 4 p. m. and 9 p. m. during the months of November, December, January and February.

A very convenient folder is issued by the New York Transportation Company, giving a list of charging stations in New York City and its environs, with a map showing their locations in Manhattan and the Bronx.

Some figures showing the performances of the New York Edison Company's 2000-lb. delivery wagons are interesting. The month of January, 1909, shows the following:

Average number of days each wagon worked	26
Average mileage of days each wagon	507
Average kilowatt consumption, charging	618.7
Average daily mileage	19.5
Average daily kilowatt consumption, charging	23.8

It will be seen by these figures that the average cost of energy per mile, figured at 3½ cents per kw-hour, is but 4.3 cents.

It is interesting to note in conclusion that there are more than 4000 electric vehicles in use in New York, which represents more than are in all the other large Eastern cities put together.

INTERIOR WIRING AND ILLUMINATION

Louisiana Electricians' Licensing Law.

By T. S. McLoughlin.

Louisiana by its 1908 State law licensing electricians has plunged the entire fraternity in New Orleans into problems of interpretation and enforcement which it is expected will eventually result in a bona fide test of its constitutionality within six months, before the Supreme Court. The preamble of Act 178 confines its provisions to cities of more than 50,000 inhabitants, and makes its terms apply to "the licensing of persons, firms and corporations conducting or managing a business for installing any wires or electric apparatus to convey electrical current, for light, heat or power, and to prevent the doing of such work by persons, firms or corporations, other than those licensed in accordance with the provisions of this act."

As New Orleans is the only city of the State of over 50,000 inhabitants, the operation of a State law is thus confined to that city alone. The board of examiners and supervisors who confer licenses has been appointed by the Governor and is actively at work. It is composed of four electrical contractors and a union labor representative, who is also its secretary. The act prescribes that they shall be practical electricians, be appointed upon nominations made by the oldest electrical contractors' association in the city and the International Brotherhood of Electrical Workers, respectively, and shall serve two years. The commissioner of police and public buildings and the fire marshal recommend two one-year men, and these four select a fifth, also serving for one year, from established electrical engineers. There are few men in New Orleans—in fact, none—who practice electrical engineering exclusively and independently, a condition of affairs due principally to the not uncommon reluctance of professional architects to reduce their own fees by the employment of either mechanical engineers or electrical specialists, and particularly the latter.

The board meets at least once a month, and conducts an examination of candidates for the term of "Master Electrician," and issues a license to the firm or corporation the applicant represents, which is also a certification of the applicant's ability. Besides passing the examination, a final requirement is a $2,500 bond to afford recourse for the real party at interest or owner for a year from date of installation against loss or damage by reason of work done or material furnished being below the standard of the National Electrical Code. This is where the insurance interest is written into the law, as a proper certificate from a legally authorized underwriter's inspector cancels the bond liability on any job or contract. A previous legislative act created the Louisiana Fire Prevention Bureau, as well as the office of fire marshal, and its inspectors will be recognized as clothed with the necessary "legal" authority.

Members of the board take the oath of State officers. Revenues must go to the maintenance of the board. Neither the per diem allowance of $5 per member for actual service, nor the secretary's salary, to be fixed by the board, can become a charge against the State or State treasury. No salary is at present enjoyed by the secretary, who is the International Brotherhood nominee.

The method of examination is patterned after civil-service rules. At present 20 questions, valuation of five points each, are selected from 200 prepared by the board, sealed and kept in a box ceremoniously brought from a safety deposit box for each examination. So difficult has it been to get suitable questions that the board has withheld from public scrutiny the questions already used, fearing that similar or identical questions may become necessary for future use when those formulated have been exhausted. Applicants must be 21 years of age. A preliminary requirement is that satisfactory evidence must be furnished the board of three years' experience as a master electrician, or its practical equivalent, such as a journeyman might offer. Experience does not figure in the examination itself, in which a percentage of 70 is required.

Supplied with writing materials, in the presence of a quorum of the examiners, they struggle through the questions in three hours. Motor questions and problems on wire sizes under given conditions are frequently included. A member of the board is emphatic in his statement that the questions are invariably based upon Code requirements. Text-books or outside asistance is denied, and papers are signed with numbers instead of names. They are now kept on file and an applicant may review his own paper, after the result has been announced, for his own satisfaction.

Under this system another class—numerically it has been as few as one and as many as six—might draw a set of questions all the same in kind or as varied as the classes of work or the departments of the Code. Persons upon whose ability a license has been issued as master electrician carry with them from one employer to another their qualification, but the board must pass upon the new employer's right to undertake the work permitted under the act to licensees. This will probably be met by treating the case as a renewal or transfer, and the new licensee will be charged the $10 fee accordingly each time a transfer is made. "Once a master electrician always a master electrician;" so several men will probably get steady jobs. The usual provision for revocation for cause of a license appears in the law, with provision that due hearing be given.

A few candidates paid $50 before succeeding and a few have failed and given up entirely, thus losing their entrance fee of $25. There are now 27 licensees, including the three largest jobbing houses, two leading fixture houses, a St. Louis contractor who has recently established an office here, a number of small contractors both in and out of the association, and the four members of the board, who are contractors. Some of the latter had their superintendents or firm members qualify as master electricians.

An estimate by the writer of receipts and expenses, necessarily uncertain in the newness of the law, is as follows:

FROM JANUARY, 1909, TO JANUARY, 1911.

RECEIPTS.

First year, 50 licenses, at $25 each	$1,250
Second year, 50 rerenewals, at $10 each	500
Second year, 12 new licenses, at $25 each	300
Total	$2,050

EXPENSES.

First year, per diem expenses five members for 15 meetings	$375
First year, stationery and sundry expenses	175
Attorney's retainer	100
Secretary's salary, at $25 per month	300
Second year, same as first year	950
Total	$1,900

The New Orleans Electrical Contractors' Association, aided by organized labor as represented by the local union of the International Brotherhood of Electrical Workers, had the law

passed on their representations. The electrical contractors had at a previous session attempted to secure legislation without result. The association will, therefore, support the law, and as newly created master electricians immediately become ardent advocates of enforcement, it will not be friendless in the face of such opposition as may develop. Meanwhile, a carpenter who undertook electrical work has been remanded under $500 bond to a higher court by a committing magistrate for taking a contract without a license and doing work after warning. Another case against a grocer's clerk who did some electrical work for his employer is yet to come up. Affidavits have been made against violators by both board members and licensed contractors.

The following sections are remarkable in their exemption of light and power companies and their provisions for punishment not only of the unlicensed contractor, but of workmen who take employment except under licensed or excepted concerns. Isolated-plant electricians are also excused.

"Section 13. Be it further enacted, etc., Nothing in this act shall be so construed as to prevent any person from doing or performing any of the kinds of work enumerated in Section five (5) of this act, when such work is performed under the direction and supervision of a duly licensed master electrician, but no work, other than minor electric repairs for the maintenance of established plants, shall be performed excepting under such direction and supervision of a duly licensed master electrician, and the said licensed master electrician shall be responsible for any and all work so done under his direction and supervision. This shall be construed as exempting lighting companies and electric railway companies and the department of police and public buildings of the city of New Orleans from the provisions of this act in so far as the maintenance and installation of their equipment, pole-line, services and meters are concerned.

"Section 14. Be it further enacted, etc., Any person, firm or corporation or any member of such firm or corporation, who shall practice or engage, or continue, in the work of a master electrician, as defined in Section five (5) of this act, without having complied with all the provisions of this act, and any person not licensed as a master electrician who shall do or perform any such work except under the direction of a master electrician, or who shall violate any of the provisions of this act, shall be guilty of a misdemeanor and upon conviction thereof, shall be sentenced to pay a fine of not less than twenty-five dollars ($25), nor more than five hundred dollars ($500), or to an imprisonment not exceeding ninety (90) days, or both, in the discretion of the court."

The definition and privileges of a master electrician are set forth as follows:

"Section 5. Be it further enacted, etc., The term 'master electrician' as used in this act shall be so defined as to include any and all persons, firms and corporations engaged in the business of, or holding themselves out to the public as engaged in the business of installing, erecting or repairing, or contracting to install, erect or repair electric wires or conductors to be used for the transmission of electric current for electric light, heat or power purposes, or moldings, ducts, raceways or conduits, together with fittings for same, for the reception or protection of such wires or conductors, or to electrically connect electric wires or conductors together, or to any electrical machinery, apparatus, device or fixtures to be used for electric light, heat or power purposes. A license of 'master electrician' issued or granted under, and in accordance with the provisions of this act, shall entitle any such person, firm or corporation so licensed to engage in the business of," etc.

A list of the questions for one examination is given below:

1. Describe some method of making a satisfactory support in conductors in vertical conduit risers.

2. What is the rule as to the circuit connecting ground detectors, pilot lights and potential transformers on switchboards?

3. In cases where dampers in theaters are released by electric devices, what is the rule as to the circuits?

4. When a ground wire is connected to gas-pipe system on house side of meter what additional precaution should be taken?

5. What is the maximum voltage between conductors in same fixtures?

6. What is the rule for sockets in damp or wet places, and how shall they be installed when not on fixtures?

7. Give brief description of material and construction of cabinets; for "K and T" work; for conduit system.

8. Would you use the same size of rubber-covered wire for wiring a 1-hp, 110-volt, direct-current motor as for a 1-hp, 220-volt direct-current motor. If not give size for both cases.

9. State the rule to be followed in starting and stopping motors.

10. What devices, protective or controlling, are required to be installed in wiring for motors?

11. What size rubber-covered wires should be used to feed 15-hp, 110-volt direct-current motor of 75 per cent efficiency at 25 per cent overload?

12. What sort of wiring is required from switchboard on theater stage to border lights, and how it may be run in accordance with the National Code?

13. What size alternating-current motor may be installed without compensator?

14. Describe the care that should be given to the brushes to keep them in good condition.

15. How should service be arranged in wiring for both light and power for direct current?

16. When can canopies on fixtures be insulated?

17. What is the rule for the type of insulation on wires in theater border-lights and footlights, and is this rule mandatory?

18. What is the ruling for installing wires passing through timbers at the bottom of plastered partitions?

19. What does the term theater mean in so far as rules and regulations of the National Code are concerned?

20. Give a formula to find circular mils when voltage, amperage, distance and actual volts lost are shown.

Photometric Units.

A rather vigorous discussion has been going on in the columns of the *Illuminating Engineer* (London) regarding the use of the term "lux," especially as regards the unit of intensity involved, whether "candle" or "hefner." Now "lux" is one of the terms peculiar to illumination for which there seems to be a real call, so that a general definition of it is rather important. "Lux" at present is universally used with the meter as unit distance, but the intensity implied may be either candle or hefner, and occasionally German writers use kerze when they really mean hefner. With the coming adoption of a standard candle unit in France, Great Britain and the United States, "lux" as used in these three countries will mean one and the same thing. It would then seem advisable for German writers to call their unit the hefner-lux or to adopt the lux accepted elsewhere. "Lux" unqualified ought to mean practically what it implied when Professor Blondel brought the term into his tentative series of light units in 1893. These units, whether adopted in whole or in part, are logical and systematic, and there is no valid excuse for going outside this excellent list in establishing a proper nomenclature for illuminating values. The proposed international unit being practically identical with the bougie-decimale greatly simplifies the issue.

Historically, "meter-kerze" antedates "meter-hefner," and the former should therefore be considered to mean what it originally implied, i. e., the lux with the candle as basis. The same reasoning should apply to the "lumen," the only other illuminating unit yet badly needed. "Lumen" was also established by Professor Blondel as part of his 1893 system, and ought to be used only in its original sense. Its use with the hefner as unit of intensity, unless so specifically qualified, seems to be quite unjustifiable from any point of view. Everyone respects the value of the hefner lamp as a concrete thing, but that is no reason for applying it tacitly as unit intensity in terms that

really mean something else. One important matter should be again here referred to, the undesirability of generally using "lux" and "lumen" prior to the official action that will give them a definite value. It will now be only a short time before such action will be taken, and then one can comfortably go ahead with the knowledge that the terms will mean the same thing everywhere. The hefner units, if so characterized, will merely be slightly inconvenient but will do no particular harm. Whether it is advisable at present to take over the whole Blondel list of units is another matter. So far as need demands, they will doubtless meet the requirements, yet as in the case of the metric system itself, subsidiary names are likely to drop out of sight unless the things that they imply meet long-felt wants. This matter will take care of itself in due season. "Hefner" has come into general use only in Germany, and its implication unspecified in "lux" and "lumen" is as improper as it would be to use "foot-pound" with the tacit understanding that the pound meant was really half a kilogram. The present mix-up reminds one of the time when Siemens units were confused with ohms and the weber disputed ground with the ampere. These conflicts were only temporary, but while they lasted they were annoying. At present the one thing needful to avoid confusion is extra care in writing to avoid ambiguous terms, and a united effort, at the earliest practicable moment, to establish in regular usage the few vital terms for which there is frequent use.

New Telephone Patents.

INSTRUMENTS AND APPARATUS.

One of the most vulnerable parts of the flexible connecting cords used at switchboards is at the base of the plug, where the cord takes a more or less abrupt turn when it is put into use. This result is attributable to the horizontal position of the plug as it stands in the jack. To overcome the difficulty Mr. E. T. Banes, of Philadelphia, has patented a slightly flexible rubber bushing, which is secured in the bore of the plug and which surrounds the cord tightly. Such a bushing will tend to reduce the abruptness of the turn in the cord and will hold this away from the conducting metal part.

A receiver forms the subject of a patent granted to Mr. A. H. Nicholson, of Wendover, England. In this receiver use is made of a wide span U-shaped magnet, each pole of which is short, and carries an inwardly projecting cup for supporting the diaphragms. One diaphragm is carried on each cup, the two standing in parallel planes a short distance apart. A ring carrying the earpiece closes in this space, by being slipped over the two cups. Within the ring is a diaphragm in the center of which is supported the receiver bobbin or coil, with its core poles confronting the diaphragms immediately opposite the polarizing poles. The diaphragm is thinned toward the side of the ring carrying the earpiece, so that an aperture is left toward each diaphragm.

An antiseptic attachment has been jointly patented by A. W. Lyda, of Pittsburgh, Pa., and E. C. Robinson, of Lowellville, Ohio. The device consists of a metal cap, similar to a watch-case cover, which contains the antiseptic absorbent in it. It is supported by a hinge to a clamping ring which encircles the lip of the mouthpiece. A pendant hook attached to the ring forms an auxiliary receiver support.

SWITCHBOARD CIRCUIT.

In two-wire common-battery systems of the Dunbar type it has been customary to arrange the cut-off relay so that it disconnects the line-relay circuits when it operates to connect to the jack circuits. Mr. W. W. Dean has patented a modification of this arrangement whereby the line relay is placed on the line side of cut-off relay contacts and thus as the cut-off relay operates it leaves the line-relay in the talking circuits. To offset this disadvantage the cut-off relay, through its contacts, puts a short-circuit around the line-relay. The patent for this arrangement has been assigned to the Kellogg Switchboard & Supply Company.

CALL-DISTRIBUTING SYSTEM.

Call-distributing systems require a combination of automatic and manual switching. Thus, a call originated by a subscriber is under his control sent into an automatic switch, which picks up a telephone line not busy and extends the call to a manual operator for completion. It will be seen that a number of lines far less than the number of subscribers served is needed between the automatic and manual devices. With such systems there should be some way for the calling party to signal the manual operator directly without "knocking down" his connection at the automatic switch. It is with a view to accomplishing this result that Mr. S. H. Browne, of Pittsburgh, has invented a retarding relay device, which he has described in a patent assigned to the American Telegraph & Telephone Company. The control of the automatic switch lies in a relay, the return movement of whose armature toward the "knock-down" position is retarded by a train of gears and escapement. Now if the caller wishes to signal, he vibrates his hook slowly, thereby affecting the supervisory lamps of the manual board. He does not "knock down" his switch, because before the "knock-down" relay can get to its backstop the relay is re-energized by the use of the hook. The "knock-down" takes place upon a long depression of the hook.

DUPLEX SYSTEM.

A duplex system for sending two non-interfering messages simultaneously over the same wires is described in a patent assigned to the General Electric Company by its inventor, Mr. M. C. A. Latour, of Paris, France. The two telephone currents are superimposed upon a high-frequency alternating current, too high to affect the human ear. One-half of each wave is then blotted out with a mercury-vapor arc rectifier. At the receiving end a rectifier is also used to refuse all currents not of proper polarity. It will thus be seen that by the use of two such outfits upon the same line wires, with rectifiers properly poled, one station may work upon the positive half-waves, the other using the negative half-waves.

TRANSMITTERS AND ATTACHMENTS.

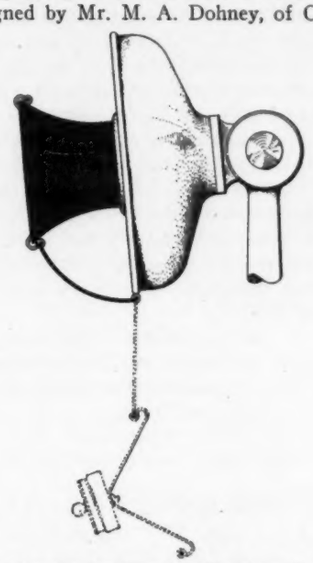
The solid back transmitter has always been distinguished by the stationary microphone cup carrying the stationary electrode in its base and the movable electrode attached to the diaphragm, which is supported upon the cup by means of an auxiliary diaphragm. In recent years a different arrangement has been used—that is, the inverted solid back, wherein the carbon cup is associated with the movable electrode and diaphragm, while the rear electrode is held stationary, the auxiliary diaphragm extending from it to the moving cup. Besides these two, there is a third type wherein both electrodes are connected to the microphone cup by means of auxiliary diaphragms; one electrode is secured to the main diaphragm and the other to the bridge, the microphone cup floating, so to speak, on the auxiliary diaphragms. Mr. H. P. Clausen, of Chicago, has obtained a patent for such a transmitter wherein an initial strain is given to the auxiliary diaphragms by either pushing the electrodes together or pulling them apart more than the normal distance. Mr. Clausen has assigned his patent to the American Electric Telephone Company.

Mr. C. Adams-Randall, of New York City, has obtained a patent for a very different type of transmitter. He uses a felt disk in one face of which is pressed a channel having a more or less complicated shape, with a view to increasing its length. At each end of the channel is a terminal electrode to which the transmitter electric circuit is attached. The diaphragm, preferably non-conducting, lies against the face of the felt, thereby sealing the channel, which latter has, of course, previously been filled with carbon granules. It will be seen that the resistance through the carbon from electrode to electrode is varied by means of the lateral pressure exerted by the diaphragm upon the granules in their channel.

It has been the practice for many years to make transmitter

mouthpieces of hard rubber, electrose, or other similar opaque and black compounds. However, Mr. W. Gibson, of Danbury, Conn., employs glass as the substance for the mouthpieces, and, as it is expensive and rather impracticable to form suitable threads upon the glass, he has designed a metal nipple, adapted to screw into the transmitter face. The nipple has a cylindrical portion beyond the threads, upon which the glass mouthpiece may be forced with sufficient friction to maintain it in place.

In the accompanying illustration is shown a disinfecting attachment, designed by Mr. M. A. Dohney, of Chicago. When



DOHNEY TELEPHONE DISINFECTOR.

it is desired to use the transmitter the wire clips are sprung and the disinfector is allowed to hang clear.

Another idea for a transmitter disinfector is that of Mr. G. M. Scroggs, of New Orleans. Mr. Scroggs provides a perforated metal lining for the mouthpiece, having a turned-back flange carrying spring clips which engage the insulating mouthpiece. The perforated lining is wrapped with a coating of absorbent, saturated with disinfectant, and over this is another metal layer which is secured by being screwed into the flange piece. The whole device, thus built up, fits the mouthpiece.

Mr. A. A. Williams, of Chicago, has also patented a transmitter disinfecting device. His device consists of a number of false mouthpieces of paper, telescoped together. The outer one is of a shape to fit the inside of the transmitter mouthpiece and the edges of all are turned back over the mouthpiece and clamped in position by means of a spring ring. Whenever it is desired to change the lining the ring spring is opened slightly and one of the layers of paper, the innermost, is pulled off and the ring is allowed to snap back into place to hold the remaining layers in position.

SWITCHBOARD TEST CIRCUIT.

For switchboard "busy" tests it has been the custom for a long time to use a tertiary winding on the operators' induction coil. This tertiary winding has usually been associated with the tip of the plug through an auxiliary contact of a relay, key, etc., so arranged that the tertiary is connected to the cord only during the period of test, before the cord is inserted in a jack. Mr. C. S. Winston, of Chicago, recently patented and assigned to the Kellogg Switchboard & Supply Company another arrangement wherein the tertiary winding is permanently connected between a grounded battery and a point in the operator's set, midway between the receiver and the induction coil secondary. The connection of this grounded test circuit is at a point which approximates a neutral point and, therefore, it has a minimum distributing effect.

RECEIVERS.

It has been well recognized for a long time that in many instances partially deaf persons can hear with the telephone receiver very readily. This is the case when the affection of the ear is one of the drums or middle ear, the inner ear being in good condition. The excitation of the inner ear is supposed to be through the bones of the skull, due to vibrations impressed from the body of the receiver in its contact with the head. In order to make this action more perfect, Mr. James Dickson, of Cleveland, Ohio, has devised a receiver with this end especially in view. He has mounted on the ear-cap, integral therewith, a boss terminating in a spherical surface, with a smaller hemisphere arising from its middle. When such a receiver is used the boss can be placed immediately in front of the ear in such a way as to make a very good contact with the skull, thereby compressing tightly the interlying tissues of the face.

Another improvement in receivers has been patented by Mr. A. Rector, of New York City, the patent being assigned to the Helpaphone Company. This improvement comprises an extension body piece for inserting in an ordinary receiver between the normal ear-cap and the body proper. A web extends across one end of the extension piece, designed to clamp the diaphragm and to provide the usual narrow air space. A tube of the same diameter as the normal cap-aperture extends from the air-space to the ear-cap. The ear-cap screws down upon the extension, its aperture registering with the tube. It is claimed that this device improves the quality of the received sound.

AN IMPROVED DESK STAND.

Many of the desk-stand or portable telephones now manufactured have a cylindrical upright, near the top of which is the hook-switch lever, while in the base are the switch springs with a more or less complicated linkage between. A patent issued to Mr. A. H. Weiss, of Evanston, Ill., and assigned to the Kellogg Company, describes such a stand with the linkage having a toggle action. The main switch spring requires a vertical displacement for its action. The hook lever has a long bent arm extending down within the tubular upright, and pivoted on its lower end is a second link which extends to the main spring of the switch. The depression of the hook causes the lever in the linkage to straighten. This action lengthens out the linkage, thereby driving down the spring before it.

MISCELLANEOUS DEVICES.

A key-type switchboard, using no cords, is described in a patent granted to Mr. F. W. Wood, of Newport News, Va. Banks of keys are so arranged that each vertical row of levers corresponds to a single line, while each horizontal row corresponds to a different cord pair. The arrangement of circuits is such that the main battery supply is in series with the supervisory signal, and when a connection has been effected, each telephone line of the connection is bridged from the ends of this combination circuit. In other words, the supervisory signal coil serves as a retardation coil in the battery feed circuit. The claims of the patent deal principally with this arrangement of circuit combined with the use of the non-inductive shunt about the supervisory signal coil.

A message-registering system forms the subject of a patent granted to Messrs. V. D. Greene and K. W. Fort, of Chicago. This system is adapted solely to automatic exchanges. It is so arranged that the subscriber must register a count before his selective apparatus will perform its functions in selecting the desired party. The arrangement is a mechanical one, the counter push being so associated mechanically with the dial mechanism that the latter will not start until after a call has been registered. As is well known, the use of distributed inductances to overcome capacity was brought to a practical solution through the inventions of Dr. Pupin. However, his inductance coils distributed along the circuit are provided with cores normally demagnetized, or practically so. A different arrangement is described by Mr. I. Kitsee, of Philadelphia, who distributes inductances along the line to improve transmission, but magnetizes the cores inductively by means of permanent polarizing magnets associated therewith.

Messrs. W. F. Wagner, of Detroit, and W. E. Shiels, of Toledo, are the joint inventors of a party-line lock-out system. The apparatus is so arranged that as soon as the receiver comes

off the hook at any station, and the operator answers, the relays operate at all stations to lock out all other stations on the line. If the desired party be on the same line as the calling party a push at the calling station must be operated to unlock the line until such time as the desired party answers.

Letters to the Editors.

Compulsory Working of Patents.

To the Editors of Electrical World:

Sirs:—Referring to the recommendation of Mr. Barkelew in your issue of March 18 concerning the compulsory working of patents, it appears to the writer that such a law would favor, not inventors, but manufacturers, who would wait until a patent was void and then avail themselves of it without cost. Such a law would be counter to American progress, since many of our best inventions have come from men of small means. As conditions now are, it is far more difficult to interest capital or manufacturers to exploit a new device than to invent and patent it, to say nothing of interesting the consumer. The nation would lose by a law making practically hopeless the case of the inventor of small or moderate means—a law also at variance with American principles. Inventors as a class are not duly paid for their services to the nation, nor are their services duly recognized except in rare cases, when public sentiment has accidentally been touched. In the end it would be more profitable to the consumer and to the nation to provide a law paying for inventions and seeing that they are worked.

Blue Mound, Mo. Edwin J. Elsas.

[Our correspondent evidently overlooked the bearing of the suggestion of Mr. Barkelew, which had in view the clearing of the field of protective and other paper patents which, it has been claimed, are gradually depriving the independent inventor of any incentive to invent owing to the manner in which such patents control some of the arts.—Eds.]

Valuation of Public-Utility Properties.

To the Editors of Electrical World:

Sirs:—I have read with considerable interest Mr. W. H. Winslow's letter in your issue of March 25, and I believe that he has brought out the point of difference much clearer than before.

Two quotations will serve to show wherein the difference lies. Mr. Winslow, in his letter, states: "It is well known that most new ventures in the public-utility line have all they can do to get enough money to cover actual cash requirements during the early years of their operation, and to take the position that a depreciation reserve which cannot be laid aside then shall not be made up later, is certainly unfair and unjust." In the summary of the Supreme Court decision, published in your issue of Feb. 11, the court states: "If, however, a company fails to perform this plain duty and to exact sufficient returns to keep the investment unimpaired, whether this is the result of unwarranted dividends upon over-issues of securities or of omission to exact prices for the output, the fault is its own. The court could not undertake to correct such past errors of management." Or, in other words, one party says: "Let the dead past bury its dead," while the other says, "Let extra profits in the future make up for past losses." This seems to be the real point of divergence of opinion, and it does not take a deep student of such affairs to see that it makes a lot of difference with the way in which the accounts may be kept.

The reasoning of the Supreme Court is given quite clearly in the article above referred to and I shall not try to add anything to it here. I would, however, like to justify, from the standpoint of the Supreme Court, the correctness of my statements with regard to the accounts.

The first case, as corrected by Mr. Winslow, is that of a partly depreciated plant which is bought and at the same time a certain amount of cash is invested which, with its interest accumulations, will, at the time of the plant's replacement, equal the amount of depreciation at the time of purchase. There are two factors to be considered here. It is probably assumed that the purchaser receives dividends on the total investment, including the price paid for the plant and the cash laid aside. At the time of replacement the accumulated interest of the cash investment is available in addition to the two sums named above. Whether this increase in assets, which thus makes up for past losses, is permissible depends upon the view taken with regard to the first proposition. There is another factor to be considered, however, in that a considerable amount of cash has been actually invested.

With regard to the fluctuation in the value of the service with the bank balance, I believe that Mr. Winslow has misunderstood me. With the same capitalization, say, initial cost of plant, and the same rates, the company with cash assets bringing in interest can pay higher dividends than the company without cash assets. With the same capitalization and same dividends the company with cash assets would have *lower rates* for current. One way of stating this is that the total earnings should fluctuate with the total assets.

With regard to charging double depreciation in order to build a new plant at the proper time, the propriety of this also depends on one's interpretation of the fundamental proposition. Of course, if it were not allowable to wipe out past losses, neither would such double depreciation be permissible. A curtailment of dividends or new issue of securities or both would be required.

I wish to add that I have not overlooked Mr. Winslow's basis of "reproductive value." It appeals to me, however, as a statement to be proved rather than as an axiom from which to work.

West Lynn, Mass. F. E. Haskell.

Uniform System of Accounting.

To the Editors of Electrical World:

Sirs:—The Public Service Commission uniform system account called "general amortization—electric" provides for a monthly charge to cover wear and tear, obsolescence and inadequacy, in which charge are included the amounts charged in the month to the various repair accounts in electric operating expenses. The rule adopted by this company for determining the amount of such charge is as follows: Multiply one cent (0.01) by the number of kw-hours sold. This rule is based on the following facts, opinions, estimates and considerations:

(A) The 10 years of this company's experience is too short a period to be of service in determining the average amount of annual reserve necessary for the equipment owned. The real amount may be determined only upon retirement of the equipment from service.

(B) The average amount necessary will change from time to time, being affected by many variables, including changes in the design, efficiency and cost of equipment obtainable, the rate of growth of business, the extent of use of equipment and other operating conditions.

(C) The many competitive sources of light, heat and power in every community must, in the long run, be the determining factor in fixing the value to the consumer of gas or electric service, and the natural laws of supply and demand be the controlling influence in regulating the rates for business actually done. The purpose of the entry being to accumulate prior to the retirement of the equipment from service a total amount of credit sufficient to offset the depreciation in value of such equipment, the rate of accumulation should be such as may best serve the common interests of the owners of the property and the community served, due regard being given to the reasonableness of cost of operation, to the return on capital necessary to attract the same, and to the rates paid by consumers for service. The amount of the charge each month should be determined by the managers of the companies, subject to the

limitations only that at no time shall the total charges amount to less than the total repair and replacement costs, nor shall any charge be made when the accumulated balance in "accrued amortization of capital" account exceeds 50 per cent of the book value of the total capital (all kinds) in service.

(D) Under present conditions the rate of amortization named for this company is expected to provide for the actual cost of usual monthly repairs and up-keep expenses and add something to the reserve accumulated for the occasional extraordinary replacements and withdrawal from service of equipment.

The gross earnings of this company are between $100,000 and $200,000, consequently we fall within the class of those having gross operating revenues amounting to less than $500,000 (condensed scheme). We have not felt that any help was needed in applying the system, insofar as it is applicable. The introduction of the system involved with us simply a lot of labor and expense and some temporary delay in getting out our reports. The trouble we experience follows the introduction of the system and, summed up briefly, consists in the fact that the accounts, both capital and income, are so subdivided as to make it necessary to estimate a very large portion of the entries. As a result, our knowledge, both of our investment and of our operating expenses, will be less than in the past and our records as a basis for accurate calculation far from satisfactory.

New York. Accountant.

Tungsten-Lamp Rates.

To the Editors of Electrical World:

Sirs:—We have read with interest the article in your issue of March 18 relating to the plan adopted by the Hartford Electric Light Company to sell energy for tungsten lamps on a candle-power rather than on a watt basis. In this connection we call your attention to section 3 of the enclosed copy of the franchise which the City Council of Richmond recently granted. It became apparent to us after installing about 1000 tungsten lamps that in small cities where the field is limited and only a few large consumers are to be found, it is impossible to make up reduced revenue with new business. The reduction in the bills of the Government Building and of hotels amounted to more than we could hope to make up by adding 50 residences, and even if we should succeed in securing the 50 new residence customers the matter of additional investment costs had to be reckoned with. We could not increase our rates to meet the situation because our franchise would not permit this. We therefore went before the City Council and secured the franchise referred to, in which the maximum rate is specified in candle-power, with the *most efficient* incandescent lamp used as a basis for computing the cost per 100 cp per hour.

The difficulty that will confront a great many central stations in changing to the candle-power basis will be that rate limits fixed by franchises are expressed in kw-hours.

It might be of interest for us to state that the city of Richmond, Ky., last September, contracted with us to furnish 120 60-watt multiple tungsten lamps on the streets to replace this number of gas lamps. These lamps were installed during October, and while some have not yet been renewed, others of the first installation had an unsatisfactory life. Since the first renewal, however, better results have been obtained, and it now appears that the installation will be a success. The illumination is much better than was secured from the gas lamps. The City Council is very proud of the installation, as it believes it is one of the first of its kind in the country.

Richmond, Ky. L. B. Herrington,
President, Richmond Electric & Power Company.

[The section of the franchise to which reference is made reads as follows: "That the purchaser of this franchise or privilege, or any successor, transferree, or assignee of such purchaser shall not charge for electricity for any purpose a rate which will make the cost of electric light to any citizen of Richmond using more than $1 worth of electricity, per month, with the most efficient incandescent lamps, more than 3½ cents per 100 cp per hour."—Eds.]

DIGEST OF CURRENT ELECTRICAL LITERATURE

Abstracts of the important articles appearing in the electrical periodical press of the world

Generators, Motors and Transformers.

Enclosed Motors for Mines.—S. A. Simon.—An abstract of a paper read before the Glasgow Section of the (British) Inst. Elec. Eng. The author discusses the safeguards that should be adopted to minimize the danger from electrically ignited explosions in coal mines. In gassy situations, under certain specified conditions, total enclosure of motors, switches, etc., is required by the mine regulations. The author discussed what protection is advisable in other parts of the mine, expressing himself generally in favor of "plate protection" instead of complete enclosure. From the observed fact that slits or gaps of not more than 0.5 mm (0.02 in.) width and about 50 mm (2 in.) depth are not sources of danger, a form of "plate protection" was devised which embraces all the advantages of gauze without its defects. It possesses mechanical strength, permits of ventilation, prevents an explosion by cooling the issuing gases and is not damaged by after-burning should this phenomenon take place. It consists of a series of plate, usually ½ mm thick and 50 mm deep, placed side by side, at a distance of ½ mm from one another in openings of the motor or apparatus casing. These plates are usually in the form of rings or hollow squares, but they can be any shape or size. Any number can be used, according to the amount of ventilation required, and the protection secured is independent of the position of the point of ignition, of the relative volume of the containing vessel to the area of opening and of the composition of the gas. A drawing of such a motor is given in Fig. 1. In an editorial note on the paper, the design of this motor case is said to be "extremely ingenious, and the author's claim that it offers a considerable advantage over gauze protection seems well founded, but the best solution of the problem appears to be to enclose the motor entirely and build the cases and covers strong enough to withstand an internal pressure of at least 200 lb. per square inch."—Lond. *Elec. Eng'ing*, March 25.

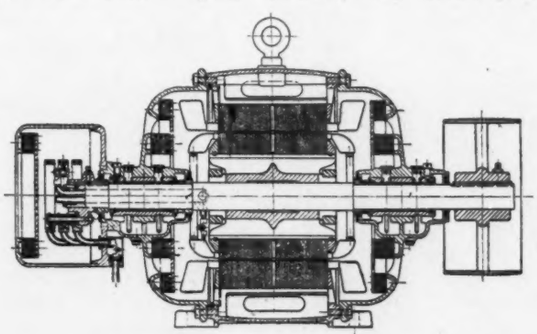


FIG. 1.—MINE MOTOR WITH PLATE PROTECTION.

Flywheel Generator.—J. Reyval.—The author first discusses the general uses of flywheel generators for direct current, and then describes a 2500-kw machine of this kind, built by a German company for a British concern to supply energy at 250 volts for lamps and motors. It is driven by a steam engine at a speed of 85 r.p.m. The rotor weighs 56,000 kg (56 tons).

The machine is satisfactory with respect to both efficiency and rise of temperature.—*La Lumière Elec.*, March 20.

Lamps and Lighting.

Low-Voltage Metallic-Filament Lamps.—O. Brandt.—An illustrated article on the use of low-voltage metallic-filament lamps, and especially osram lamps, for automobiles and yachts, etc. The comparison is made between the cost of operation of a 16-hp, low-voltage, carbon lamp with a useful life of 500 hours and an analogous osram lamp. The ratio of the cost of energy in the two cases is 2.75 to 1. The Zeppelin airship on its recent trip was lighted at night with 8-cp osram lamps. —*Zeit. f. Beleucht.*, March 10.

Metallic-Filament Lamp.—A note on a recent British patent of T. McKenna (19,118, 1908; March 18, 1909). To prevent the filaments from sticking to the metal supporting hooks, the latter are coated with a lower oxide of tantalum or niobium. The iron or nickel hooks are dipped in colloidal tantalic or niobic acid, dried, and then heated to about 1300 deg. C. in hydrogen to convert the coating into the required oxide.—Lond. *Elec. Eng'ing*, March 25.

Lighting with Tungsten Lamps.—J. S. Codman.—Some notes on the lighting of a clothing store in which 68 arc lamps were replaced by 185 100-watt tungsten lamps equipped with prismatic reflectors, and the saving in energy consumption in the different rooms varied from 34 per cent to 62 per cent. Illuminating tests were made with a Sharp-Miller photometer. Some details of the tests are given.—*Illum. Eng.*, March.

Generation, Transmission and Distribution.

Electric Winding in Mines.—An illustrated description of the equipment of the Clausthal Government mines in Germany. At the Ottilia mine the Ward Leonard system is used in connection with a battery. The winding engine is fitted with a Koepe pulley, on the shaft of which is keyed the armature of the main shunt motor. The field winding of the latter is fed with current at constant voltage, being connected to a constant-voltage generator *A* driven by a special motor. This arrangement is shown in Fig. 2. The generator e.m.f. can be varied from zero to 500 volts by altering the regulating resistance in the field winding. This resistance being operated from the driving handle it follows that each position of the rheostat corresponds to a definite speed of the winding motor. The battery used with this set consists of 242 cells with a normal charging current of 108 amp, the discharge current being 220 amp. This battery is employed for the purpose of smoothing down the peaks in the load curve, and is connected with the system and a booster as shown in the diagram. This allows energy to be taken from the battery during heavy loads, while when the load is light the battery is charged. The depth of the mine shaft is nearly 1900 ft. (570 m), the normal load ¾ ton

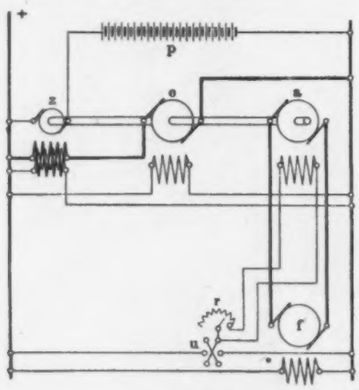


FIG. 2.—DIAGRAM OF ELECTRICAL WINDING GEAR.

(750 kg), and the usual working speed 12.2 ft. (3.7 m) per minute. The control platform of this winding engine is fitted with suitable instruments, including a tachometer and a tachograph, as well as a gage for showing the air pressure for working the brake. The compressed pressure is produced by means of a small direct-current motor. The compressed-air brake is used only for bringing the cage to rest, and for holding it in position another brake can be operated either by the driver or by the depth indicator, when the bank is overrun. It also comes into operation if a given speed is exceeded, and this depends only upon the position of the control handle. This apparatus is capable of dealing with 300 tons (300,000 kg) during a 10-hour shift, the journey being made in 54 seconds.—Lond. *Electrician*, March 26.

Electric Motors in Cotton Mills.—W. Hoult.—A paper read before the Liverpool University Engineering Society, on electric driving in cotton mills. A small three-phase motor to each loom is the most satisfactory arrangement, as the looms can then be run at a considerably higher speed, which naturally increases their production. The threads, moreover, do not break so often and the cloth has a more regular appearance, obtaining a better price than cloth woven from engine-driven looms. The author strongly advocated the individual drive for all machinery in weaving sheds and spinning mills, with the exception of mules and possibly carding engines. A discussion followed the reading of the paper, chiefly on the relative advantages of induction motors as compared with direct-current machines for this class of drive, "it being generally conceded that the combination of three-phase turbo-generator and induction-motor drives had great advantages, this system also enabling the repulsion motor to be used to the fullest advantage for the ring frames."—Lond. *Electrician*, March 19.

Traction.

London Tramways.—J. H. Rider.—The first part of an illustrated paper read before the (British) Inst. Elec. Eng. A description is given of the development of the London Council Tramways undertaking, and of the equipment of the Greenwich generating station. The engine-room contains at present four vertical horizontal reciprocating engines, coupled to alternators of 3500-kw rating at a power factor of 0.55. Two additional turbo-alternators of the same rating are also in course of erection. The total normal rating of the station is, therefore, 34,000 kw, but as each set is capable of dealing with an overload of 25 per cent, the station can, on emergency, be worked up to 42,500 kw. Allowing one reciprocating and one turbine set as reserves, the maximum working load may be taken at 30,000 kw. —Lond. *Electrician*, March 26.

Electric Tramways in Brazil.—An illustrated description of the system of electric tramways in Para. The total length of track constructed for electric working is 55,060 m (33 miles), of which 26,000 m (16 miles) of single track are laid in paved streets, and 21,600 m (13 miles) in unpaved streets, all with girder rails. Sleeper construction was employed throughout the whole of the work, with rails of 90 lb. to 96 lb. per yard (45 kg to 48 kg per meter), thermit joined, on paved streets. On unpaved streets continuous joints were employed. The power plant contains three 400-kw, direct-current traction generators, and two 2000-volt, 50-cycle, single-phase generators for lighting. —Lond. *Electrical Review*, March 26.

Electric Traction on Railways.—P. Dawson.—A continuation of his long, illustrated serial. In the present installment he discusses the method of fire protection of the cars and the systems of wiring.—Lond. *Electrician*, March 26.

Installations, Systems and Appliances.

Contacts in Electrical Apparatus.—G. J. Meyer.—The conclusion of his paper on contacts in electric apparatus. The change of the contact resistance due to a film of air, etc., is shown in Fig. 3. The abscissas represent the pressure of the two contact surfaces upon each other in atmospheres. The ordinates represent the contact resistance in milliohms per square centimeter. The three curves refer to brass contacts. Curve I shows the contact in air, while curve II shows the increase of resistance after the apparatus had been laying in a factory with suction-gas plant, the increase of resistance being due to a film of gas. Curve III gives the resistance immediately after the contact had been slightly treated with vaseline. The author describes a series of experiments which he has made

with various apparatus like cell switches, etc., and discusses the so-called fatigue of contacts which results when the elasticity limit is exceeded so that the pressure is reduced and the resistance and temperature are increased. In the discussion which followed, Schortau remarked that aluminum contacts always

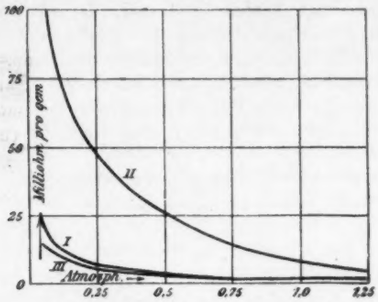


FIG. 3.—CONTACT RESISTANCES.

show an increase of contact resistance after a short period of use.—*Elek. Zeit.*, March 25.

Electric Installation in a Department Store.—A description of the electric equipment of a large department store in London. Energy is taken from the St. Marylebone Borough Council's 2 × 240-volt, direct-curent mains, from which nine service cables are brought into the building. Thirty-six-lamp and 20-motor circuits are controlled from a main board in the lowest basement. All of the cables are run in solid-drawn screwed conduit embedded in the concrete walls and floors. About 280 arc lamps and 6000 incandescent lamps are employed, a special feature being the concealed window lighting with osram lamps. The applications of motors comprise a group of nine electric lifts and several motors driving fans, pumps, air-compressors, and other machinery. A very complete system of fire protection, with automatic fire-extinguisher apparatus, has been installed. Another novelty is the use of the lamp call signals for the heads of different departments.—Lond. *Elec. Eng'ing*, March 25.

Electric Energy from Wind.—A description of a wind-driven generating plant of English manufacture suitable for supplying energy both for lamps and motors in isolated districts. A storage battery is, of course, included in the installation, and relay switches for automatically controlling the pressure of the generator are provided. The load on the wheel is increased as the speed, and consequently the power, increases. The plant consists of a 16-ft. (4.8 m) diameter wind turbine on a steel tower 50 ft. (15 m) high. The generator is of 2-kw rating and has a speed variation from 800 r.p.m. to 1600 r.p.m. The storage battery is charged whenever the wind attains a speed of six miles (10 km) per hour. The plant running at the works is capable of producing about 1500 kw-hours per year with the conditions of the winds such as obtain in London at the height of 50 ft. (15 m), but, by running the tower higher, better results would be obtained. On some parts of the coast the wind power available is from three to four times as great as that in London.—Lond. *Electrician* and *Elec. Review*, March 26 (illustrated); Lond. *Elec. Eng'ing*, March 25.

Electricity on Board Ship.—A. P. CHALKLEY.—An illustrated paper read before the New Castle Section of the (British) Inst. Elec. Eng. The author discusses the reasons for the adoption of low pressures for distribution on board ships, and then describes typical arrangements of switchboards. The various uses and applications of electricity for motive power are considered, and finally the application of electric motors for the propulsion of ships.—Lond. *Electrician*, March 26.

Prevention of Accidents.—A set of proposed regulations for the prevention of accidents in electric installations. The regulations were worked out in co-operation with iron and steel men, mining engineers, chemical engineers, etc., by a committee of the German Association of Electrical Engineers.—*Elek. Zeit.*, March 25.

Electrochemistry and Batteries.

Iron Reduction in Electric Furnace.—F. E. CARCANO.—In Italy, where the acid industry is well developed, there are very large pyrite residues, containing some 50 per cent of metallic iron. The author shows that under the particular local conditions the electric furnace is superior to the blast furnace for extracting the iron and describes his large-scale experiments in this line. He also emphasizes some special possibilities of the electric furnace for the production of pig iron and alloys of iron with silicon, etc.—*Electrochem. and Met. Ind.*, April.

Progress in Electrochemistry.—F. M. PERKIN.—A concise summary of advances made during the last year in industrial electrochemistry and electrometallurgy.—Lond. *Electrician*, March 26.

Units, Measurements and Instruments.

British Physical National Laboratory.—An abstract of the annual report for the year 1908. It is noted that recent intercomparisons of resistance standards of the Laboratory, the Reichsanstalt, and the Bureau of Standards at Washington give identical values for the high-resistance coils, which the values assigned to the unit coils differ by not more than 1 part in 100,000. The number of tests made in the Physical Department was 14,153, of which 300 were electrical measurements, 1615 related to "electrotechnics" and 779 to photometry. In regard to general electrical measurements the experiments in connection with high-oscillation frequencies will be continued. It is proposed to construct additional coils for the standard wave meter so as to extend its range considerably in both directions, and for the same purpose to make another small air condenser of constant value. The preparations for experiments with Poulsen arc lamps are practically complete, and it is hoped that the work may be commenced very shortly. The large aluminum-disk air condenser will be completed, and it is proposed to build another glass-plate condenser to give additional range of frequency. Other methods of measuring high frequency will be considered. In continuation of the work on inductances, it is hoped to complete the marble variable mutual inductance, and to make a fixed secondary standard. The construction of a large self-inductance coil of low resistance, and in sections, is also proposed. Improvements are under consideration in the methods and apparatus for determining the constants of telephone inductance. These will include the completion of the high-frequency alternator. It is hoped also to make an investigation of the methods of measuring effective resistance, which is of great importance in telephone work. Among other work in contemplation may be mentioned the investigation of new methods of measuring small alternating-current iron losses and constants of transformers. The work on transformers will involve the construction of a variable mutual inductance from 0.001 up to 1 microhenry. It is intended to investigate thoroughly the accuracy with which it is possible to standardize lamps exhibiting small differences in the color of the light they emit. Details of tests are now arranged with the Reichsanstalt with the object of defining, if possible, with greater precision the ratio between the hefner and pentane units. In connection with the tests on new resistance alloys, and also on various samples of an alloy used for making resistors for use in the Laboratory, it has been found that the temperature-resistance coefficient varies considerably with different samples of the same alloy and also with different sizes of wires of the same batch of material. Some preliminary tests have been made, and it is proposed to investigate the discrepancies fully. An abstract of the report of the director, R. T. Glazebrook, is also given.—Lond. *Electrician*, March 26.

Photometry Standards.—In the report of the Director of the (British) National Physical Laboratory for 1908 it is stated that the photometry tests substantiate the reliability of the 10-cp pentane lamp of Harcourt as the primary standard of candle-power. Progress has been made in the establishment of two sets of standard lamps of a higher efficiency, and therefore of whiter light than those commonly used for electric sub-standards. These run at 3.5 watts and 3.1 watts per candle respectively, and have been carefully aged before standardization. Graphitized carbon-filament lamps have been found valuable for this purpose. Efforts are being made to obtain satisfactory metallic-filament lamps to give further steps down to 1.5 watts

per candle. In this way it is hoped that in the near future reliable standards may be issued to those concerned with the photometry of metallic-filament lamps. Reference is made to the paper read by Dr. Glazebrook at the British Association in Dublin, explaining differences in humidity measurements as calculated from ventilated and unventilated hygrometers. Some valuable intercomparisons of light standards have been made with the National Laboratories of France and the United States of America. In February Dr. Rosa, of the Bureau of Standards, Washington, brought over a set of standardized electric lamps for intercomparison of candle-power units. The result of the measurement showed the Bureau of Standards unit to be 1.6 per cent greater than that of the N. P. L. Some of the lamps were brought over again in October and the same value obtained for the difference between the two laboratories. At the same time M. Laporte, of the Laboratoire Central at Paris, brought some standard lamps for comparison with the N. P. L. standards, and results were obtained which showed that within the limits of experimental error the units of the two laboratories may be said to be in agreement.—Lond. *Electrician,* March 26.

Two-hundred-thousand-Volt Voltmeter with Compressed-Air Insulation.—E. A. Watson.—A description of a high-tension voltmeter for which compressed air was adopted for insulation instead of oil because of the somewhat unsatisfactory behavior of oil under high direct-current pressure. In the instrument illustrated in Fig. 4, which is intended to read up to 200,000 volts, an air pressure of 200 lb. per square inch (14 kg per square centimeter) is employed. Joints are made with rings of composition sheeting placed in grooves in such a manner that they cannot squeeze out. All joints at terminals, etc., are made self-sealing, and the air pressure can be maintained for long periods without any appreciable drop. In order to avoid brush discharges the moving member A is built of copper sheet beaten on a former of such shape that no sharp edges are presented, the construction being evident from the illustration. By appropriate shaping of this and the fixed member B, the deflection is caused to be nearly proportional to the pressure, and a fairly uniform scale is obtained. The clearance between the fixed and the moving members increases with the pressure, and for the maximum, deflection is about 2 cm (0.8 in.). The dielectric strength of the compressed air employed (at 200 lb. per square inch) is about 400,000 volts per centimeter (1,000,000 volts per inch). As can be seen from the illustration, a mirror E is attached to a steel shaft C on which the moving part is mounted. A lamp throws a beam of light through the glass window in the case onto the mirror, which reflects it onto a scale F not shown in the drawing. The torque on the moving part is considerable, and acts against a coiled spring D of heavy piano wire.—Lond. *Electrician,* March 26, and *Elec. Eng'ing,* March 25.

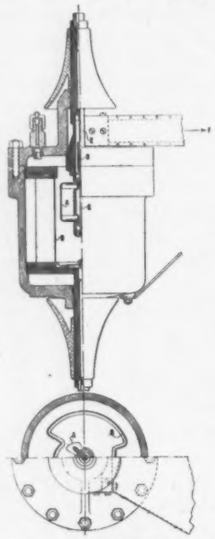


FIG. 4.—VOLTMETER FOR 200,000 VOLTS.

High-Tension Voltmeter.—A note on an electromagnetic voltmeter used in the (British) National Physical Laboratory for direct measurement of pressures up to 100,000 volts. The apparatus consists of a 500-volt large-dial voltmeter, taking 0.02 amp for full deflection and capable of being used to an accuracy of 2 parts in 1000. In series with this are 18 resistors, having a total resistance of 5 megohms, the whole being capable of connection across the 100,000-volt mains, and dissipating in all 2 kw. By special arrangement of high-tension multipoint switches, sections of the resistor are short-circuited, thereby giving various ranges from 500 volts to 20,000 volts. For higher ranges than this the ratios are changed by special contact pieces across the boxes.—Lond. *Electrician,* March 26.

Comparison of Mutual Inductance and Resistance.—A. Campbell.—A standard mutual inductance has been constructed for the (British) National Physical Laboratory, its value calculated from the dimensions being 10.0178 millihenries. It forms an extremely accurate standard, against which both mutual and self-inductances can readily be tested. In addition to this it affords a means of ascertaining the resistance of resistors in absolute measure, and thus evaluating the ohm. The comparison of resistance with mutual inductance can be made very simply and directly by the use of two-phase alternating currents as follows: In Fig. 5 M is the mutual inductor (a small fraction of it being adjustable) and R the resistor; and $A \cos pt$ and $B \sin pt$ are currents in time-quadrature. For example, from a two-phase alternator or a phase-splitting device, let G be a vibration galvanometer tuned to frequency n, where $p = 2\pi n$. When the galvanometer shows no deflection, the e.m.f. introduced into its circuit is zero at every instant, and $R = p M \times A/B$. This arrangement gives a direct comparison between R and M when p and A/B are known. By observing the speed of the alternator, p is found, while the ratio of A to B is obtained by means of the electrostatic voltmeter V, which is put alternately across the resistors of equal resistances, r_1 and r_2, or by a differential electrodynamometer. In practice A is made very nearly equal to B. The condition of balance is arrived at by alternating R, M or p until the galvanometer deflection becomes zero, accurate time-quadrature being maintained by adjusting the self-inductance l_2. For example, if $A = B$, for $M = 10$ millihenries and $R = 5$ ohms, the necessary frequency is about 80 cycles per second. The results obtained have been encouraging and appear to indicate that the method is susceptible of high accuracy. The National Physical Laboratory intends to make a determination of the ohm by this method during the coming year.—Lond. *Electrician,* March 26.

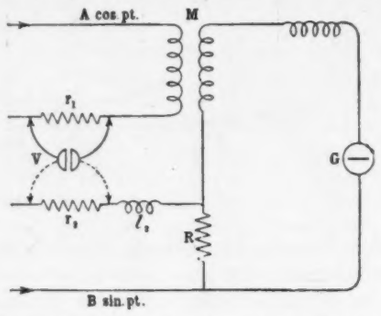


FIG. 5.—MUTUAL INDUCTANCE AND RESISTANCE.

Electrolytic Meter.—A note on a recent British patent of W. M. Mordey and G. C. Fricker (3995, 1908; March 18, 1909). Polarization, which causes serious errors in shunted meters working on light loads, is compensated for by inserting a resistor with a high temperature-resistance coefficient in series with the meter. This resistor is heated by its own current or by heat produced by resistance in the main circuit, so that the current through the cell at heavy loads is decreased in the same proportion as it is decreased at light loads by polarization.—Lond. *Elec. Eng'ing,* March 25.

Wavemeter.—In the annual report of the Director of the (British) National Physical Laboratory it is mentioned that a standard wavemeter has been constructed, consisting of an air condenser of variable capacity, a set of self-inductance coils, and a thermal-ammeter. In order to obtain an absolute calibration of the wavemeter, the frequencies of the oscillations with which it was tested were determined by including a spark-gap in the main oscillation circuit (to which the wavemeter was loosely coupled), and photographing the spark trains by the help of a rotating mirror. The mirror was concave (200 cm = 80 in. radius) and was mounted in a special long camera. It turned on a vertical axis and was rotated by a small motor, the speed being observed and controlled by the help of a commutator on the shaft connected to a condenser, bridge, and galvanometer for Maxwell's method. The application of a small

brake enabled the galvanometer light-spot to be held at zero, and hence the speed could be kept at a known and constant value. From measurements of the distance from spark to spark in the wave trains, the speed of the mirror, and the distance from the mirror to the plate, the frequency was deduced. Observations were made over a range from $n = 300{,}000$ to 1,000,000 periods per second (wave lengths 1000 m to 300 m) and the results were compared with those obtained by calculation from the capacities and inductances of the wavemeter, which had been measured at ordinary frequencies, a small correction (less than 1 in 1000) for distributed capacities being made by means of Glazebrook and Lodge's formula. The results show good agreement and indicate that in a single layer coil of well-stranded wire, of the types used, there can be very little variation in the effective self-inductance over a range of frequency up to at least 1,000,000 periods per second.—Lond. *Electrician*, March 26.

Testing Transformers.—E. KRAUS.—A paper on the methods used by the Siemens & Halske Company for testing electric meters both for direct and alternating current. For testing alternating-current meters a transformer of the design shown in Fig. 6 is employed. The points *M* and *N* are connected to supply network. The number of turns in circuit between *A* and *B* is regulated roughly by means of the two sliding contacts *A* and *B*, and more accurately by means of the sliding contact *S*. The main current coil of the meter under test is connected to the points *A* and *B*.—*Elek. u. Masch.*, Vol. 26, 1908, page 71; abstracted in *Elek. Zeit.*, March 25.

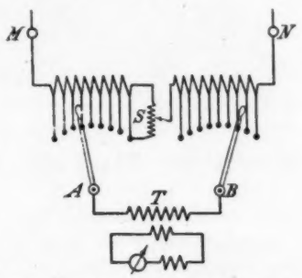


FIG. 6.—TESTING TRANSFORMERS.

Weston Standard Cell.—In the report of the Director of the (British) National Physical Laboratory for 1908 it is mentioned that more than 100 Weston normal cells of various forms have been set up during the year, and these, together with a large number of older cells, have been intercompared from time to time. The depolarizer still continues to receive attention, and the constancy of the voltage of the cell over long periods of time has been stated by Hulett to be a function of the quantity of free acid present in the cell. The quantity of free acid in the N. P. L. cells must be exceedingly small. The majority of the cells contain mercurous sulphate precipitated chemically, and, after washing, the sulphate thus prepared is probably as free from acid as the salt prepared by other methods. Observations have also been made on cells kept in a state of continual pendular motion for six weeks, the velocity of the ends of the limbs of the *H* vessel being about 20 m (66 ft.) per minute. The object was not to test the cathode system alone, but to test the general effect of agitation on the cells. Six cells were employed, and the depth of paste was varied from 0.5 cm to 8 cm (0.2 in. to 3.2 in.). The agitation did not appear to accelerate any action tending to lower the e.m.f., for in one case only did the voltage fall by so much as 1 part in 100,000.—Lond. *Electrician*, March 26.

Telegraphy, Telephony and Signals.

Telephone-Receiver Impedance.—R. T. WELLS.—Rayleigh and Wien have examined telephones with regard to their current sensibility by measuring the least current that would produce audible sound at different frequencies, and Austin with regard to the volt sensibility by measuring the least impressed electromotive force that would produce audible sound at different frequencies. A curve of either sort can be converted into one of the other if the impedance of the telephone at the different frequencies is known. Fig. 7 shows the results of the author's determination of resistance, inductance and impedance for different frequencies for one of a pair of head telephones made for use as a wireless telegraph receiver. Its direct-current resistance was 531.6 ohms.—*Phys. Rev.*, March.

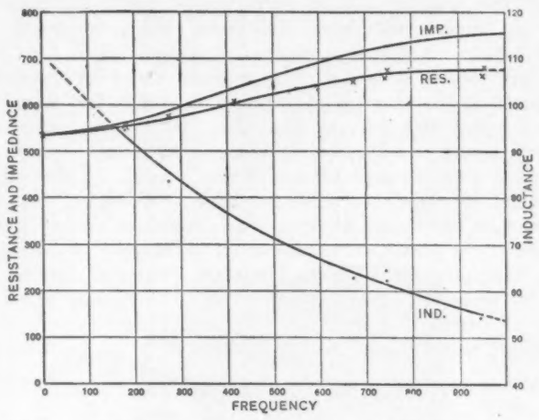


FIG. 7.—RESISTANCE, INDUCTANCE AND IMPEDANCE CURVES.

Compressed-Air Insulation in Wireless Telegraphy.—C. C. MONCKTON.—With reference to a recent paper on the dielectric strength of compressed air, the author discusses the use of compressed air in the spark transmitters of wireless telegraph installations for the purpose of increasing the range of the apparatus. It permits higher potentials to be used with the same gap, and for a given potential. The smaller gap, and consequently lower resistance when compressed air is used, reduces the damping effect.—Lond. *Elec. Eng'ing*, March 25.

Hungary and Austria.—W. MAURER.—Statistical notes on the telegraph and telephone service in Hungary in 1907.—*Elek. u. Masch.* (Vienna), Feb. 21. The effect of the new telephone tariff in Austria is discussed by H. von Hellrigl. The results have been rather unfavorable from the financial standpoint. The number of messages transmitted has decreased. While the number of telephone connections has increased, the increase is mainly in party, for which a very low rate is charged.—*Elek. u. Masch.* (Vienna), March 21.

Miscellaneous.

Electrical Industries in 1908.—GLIER.—A review of the principal commercial developments in the German electrical industries during the last year. The export trade of Germany, England and the United States is discussed, the supply of copper and the drop of the copper price; the proposed tax on electricity in Germany; the present conditions of electric traction on railways in different countries; the possibility of higher efficiency in generating electrical energy. Statistical tables are finally given of dividends paid by German electrical companies and of stock quotations during the last 10 years.—*Elec. Zeit.*, March 25.

Electricity in Horticulture.—A note stating that considerable advantages have been made in the applications of electric energy in market-gardening operations at Bitten, near Evesham, where J. E. Newman, who is specializing in this branch with Lodge apparatus, has succeeded in obtaining very promising results with lettuce and strawberries in blocks of glass houses planted with these crops. Three houses of the latter crop are devoted to the experiment, two electrified and one non-electrified. The practice of applying electricity to growing crops is gaining favor, and a Scottish landowner has just decided to put a 23-acre plant on one of his farms. It is intended to form a syndicate to work the system, and Sir Oliver Lodge is said to take a keen interest in this development.—Lond. *Electrician*, March 26.

Electric Welding.—An electric welding plant has been installed in a London wheelwright's shop for welding tires. The jaws of the welding machine are water-cooled, and about 65 hp is taken for 2.5 minutes during the operation of welding.—Lond. *Elec. Eng'ing*, March 25.

BOOK REVIEWS.

Jahrbuch der Drahtlosen Telegraphie und Telephonie. First Quarter volume. Dr. Gustav Eichhorn. Leipzig: S. Hirzel. 184 pages, illustrated. Price, 20 marks per volume.

This volume is No. 1 of a proposed series of quarterlies devoted to the progress of wireless telegraphy and telephony, commencing with the year 1907. The first part contains papers by F. Braun on "Directed Wireless Telegraphy"; by H. Th. Simon on "Undamped Electric Waves"; by J. A. Fleming on "Recent Developments in Electric-Wave Telegraphy," and several other well-known workers in this branch of applied science. Some of the papers are mathematical in character, while others are descriptive. Among the latter are illustrated descriptions of the recently erected wireless stations of Germany at Nauen and of Denmark at Lyngby. The range of the Nauen station is stated to be about 3000 km overseas and 1350 km overland with St. Petersburg, Russia. A 25-kw alternating-current generator is installed. There is appended a very full bibliography of literature on the subject. The publication promises to be a valuable reference book of wireless telegraph literature.

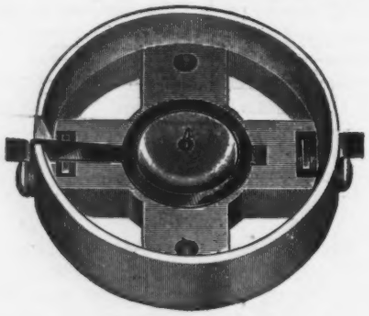
Elektrochemie. By Dr. Heinrich Danneel. Leipzig: C. J. Göshen. 158 pages, 26 illustrations. Price, 0.80 mark.

This little volume is an elementary text-book on electrochemistry from the standpoint of the student in technical schools and colleges. It is divided into three chapters. The first deals with electrical measurements and electrolytic constants. The second discusses the processes of electrolytic conduction, and the third treats of the electrochemistry of solutions. The description is clear and well adapted to a student's reading. The presentation is that of an electrochemist as distinguished from that of an electrochemical engineer. The book is well adapted to the use of laboratory students.

NEW APPARATUS AND APPLIANCES

Thermostat for Alarms.

A thermostat which is applicable for fire-alarm circuits, temperature regulators, hot-bearing alarms, etc., is illustrated herewith. The device is made by the Copenhagen Automatic Fire Alarm Company, of Sheboygan, Wis., and consists of a copper disk and a concave silver plate or diaphragm, the two when hermetically sealed forming a capsule about the size of a dime, mounted on a small porcelain base with the necessary electrical connections. In the capsule is a liquid which at a certain fixed



THERMOSTAT.

temperature forces the silver diaphragm with a positive snap from concave to convex, thereby closing the electric circuit. When the temperature is reduced again, the diaphragm snaps back to its original concave form. Ordinarily the device is used in connection with an annunciator so that the seat of trouble is quickly located. The thermostat is set to operate at a temperature of from 10 deg. to 20 deg. above the maximum normal temperature of the room in which it is placed.

Tubelite.

A new type of reflector for illuminating show-windows, showcases, etc., has been brought out by I. P. Frink, New York. The reflector occupies only 2¼ in. space, and can be made in any

TUBELITE.

length up to 10 ft., without seams, and finished in any color desired. Another feature is that standard-base tubular lamps are used, which lamps can be purchased in any electrical supply store; and should a lamp burn out, there will be only a 6-in. unlighted space. Illuminations from 8 to 64 candle-feet can be obtained, according to the lamps used. The new reflector has been given the trade name "Tubelite."

Cut Meters for Machine Tools.

The accompanying illustration shows a new "Cut Meter" recently placed on the market by Schuchardt & Schutte, 90 West Street, New York, known as the "Cito," and built on the lines of the tachometers made by this firm. The indicating mechanism is actuated by accurately balanced centrifugal weights, and the readings are correct in any position. As the readings do not depend on magnetic action, these instruments, it is claimed by the makers, remain accurate under all shop conditions, and are not affected by the magnetic fields present in shops equipped with electric power. They also indicate with the work running in either direction.

The standard range of the "Cito" meters is from 20 ft. to 600 ft. per minute, arranged in two scales, the first scale being

CUT METER.

from 20 ft. to 120 ft. per minute, and the second range from 100 to 600 ft. per minute. Either range is thrown into action by moving the thumb slide on the face up or down to the de-

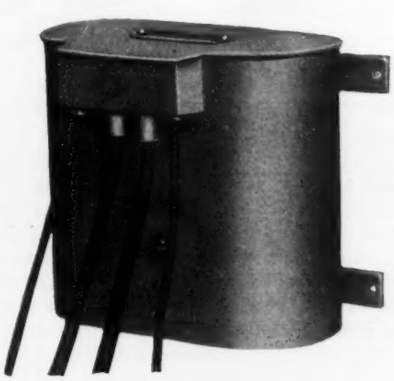
sired range. The shell or case is made of aluminum, which reduces the weight to approximately 10½ oz. The handle can be unscrewed, which makes it conveniently portable. With each instrument a rubber tip is also furnished for recording revolution of shafts up to 900 r.p.m. When used as a tachometer a formula is furnished for converting the scale reading in feet to the equivalent in revolutions per minute. The meter is put up in a leather case with an extra tier for the measuring disk.

Large General Electric Warehouse.

The General Electric Company is about to remove its warehouse in Chicago from 434 East Illinois Street to the large Pugh terminal warehouse extending from 462 to 582 on the same street. Here the company will have 10 floors and about 110,000 sq. ft. of floor space. The lease is for 15 years, with the privilege of getting more space in the immense building as required. The space occupied in the old warehouse was 78,000 sq. ft., and in addition an extra 15,000 sq. ft. was leased. In the space which has just been leased the company will carry a large stock of the lighter forms of electrical apparatus, such as motors, lamps, meters, transformers and the like. Here also will be the Chicago repair shops. The company will abandon its old steam plant and operate the shops by electric motors supplied with energy from the mains of the Commonwealth Edison Company. The warehouse is located near the proposed outer harbor on Lake Michigan, and by lighterage is connected with all the railroads entering Chicago. The General Electric Company also possesses large warehouses in Philadelphia and San Francisco, but it is believed that the one in Chicago is larger than either of these.

Transformer for Low-Voltage Circuits.

The Kuhlman Electric Company, of Elkhart, Ind., has brought out a line of transformers ranging in rating from ¼ kw to 1 kw and designed primarily for feeding energy to low-voltage tungsten lamps on electric signs. The primary winding is designed for standard low-potential circuits of 110 volts and 220 volts, the ratio of transformation being 10 to 1 and 20 to 1,



TRANSFORMER FOR LOW-VOLTAGE LAMPS.

respectively. A galvanized sheet-metal case houses a core-type transformer with auto-coil windings protected by insulating compound. The accompanying data are applicable to the line of transformers mentioned:

Rating, kw.	Core loss, watts.	Copper loss, watts.	Efficiency, per cent.	Temperature rise, deg. C.	Weight, lb.
¼	14	6¼	92.5	30	24
⅓	14	8½	93.6	31	27
½	21	11	94	33	37
¾	25	13	95	35	44
1	29	18½	95.6	38	50

The drop is compensated for in the windings and normal secondary voltage is said to be maintained at full load. The temperature rise was calculated by the increase-of-resistance method after the transformers had been under full load for eight hours. Other apparatus coming within their range can, of course, be used in connection with the transformers.

Portable Suction Cleaner.

The accompanying illustrations show the details of the aspirator made by the Portable Air-Suction Cleaner Company, of New York City. The apparatus consists of three bellows driven through pinion, gear and shaft by a 1/6-hp General Electric motor of either the direct-current or alternating-current type. The bellows exhaust from a common chamber communicating

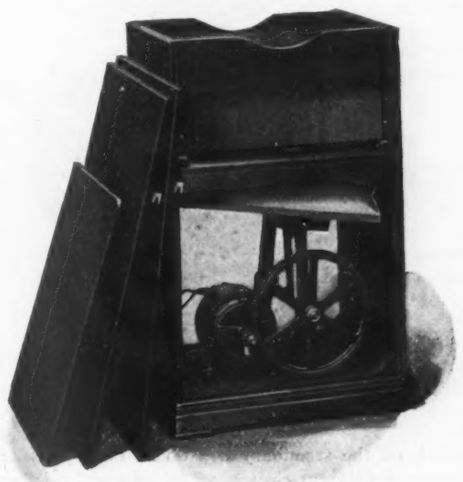


FIG. 1.—PORTABLE SUCTION CLEANER.

with a tin dirt receptacle, the suction pipe being protected by a cloth screen wound around a wire guard which suffices to keep dust from passing into the bellows. The dirt receptacle is removable so that the accumulations are easily disposed of. The entire equipment is housed in a polished-wood cabinet with removable sides and top, as shown; proper connections being

FIG. 2.—PORTABLE SUCTION CLEANER.

provided for the suction hose and for the wires feeding electrical energy to the motor. The aspirator is mounted on ball-bearing castors, so that it can be easily moved from place to place, and the necessary electricity can be taken from any convenient lamp socket.

Transformer for Bell-Ringing Circuit.

The General Electric Company, Schenectady, N. Y., has recently placed on the market a transformer for ringing electric bells. This has a low-voltage secondary winding with taps giving 6, 12 or 18 volts when the primary is connected to the ordinary 110-volt lighting circuit. The transformer will operate on circuits ranging in e.m.f. from 100 to 130 volts at the usual lighting frequencies.

The entire transformer is so small that it may be held in the hand, and is designed in such a manner that a continuous

TRANSFORMER FOR BELL-RINGING CIRCUIT.

short-circuit on the secondary will do no damage either to the transformer or adjacent circuits. The core and coils are placed in a small metal box with lugs or feet attached for convenience in fastening to the wall or ceiling. A screwdriver is the only tool needed for installing the transformer, after which it is said to require no attention whatever; this is in strong contrast to the ordinary primary battery. The transformer may also be used to advantage for operating buzzers, spark-coils, burglar-alarms, miniature lamps, door-locks, gas-lighting and annunciator systems.

All-Metal Telephone.

The Connecticut Telephone & Electric Company, of Meriden, Conn., has recently placed on the market a new type of all-metal telephone to be used in connection with its hotel, apartment and

ALL-METAL TELEPHONE.

two-line interior telephone system. This telephone is designed, of course, principally for battery call service, but it can also be arranged for common-battery exchange service. The instrument is equipped throughout with the very best long-distance parts and all cord and line connections are made inside the case. The telephone is finished in black enamel with nickel trimmings.

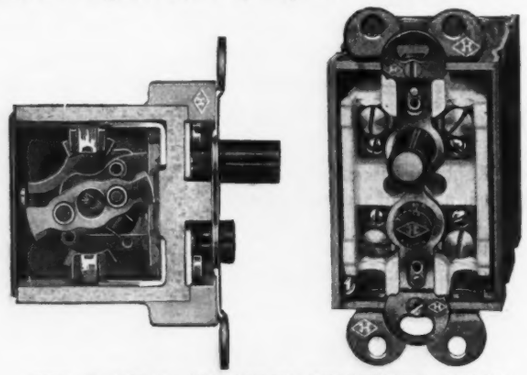
Lubrication by Pure Mineral Grease.

A practical test of the economy of pure mineral grease in electric railway work is stated to be under way on the Providence & Fall River Interurban Road, the object being to demonstrate the superiority of the lubricant in question, Keystone grease, manufactured by the Keystone Lubricating Company, of Philadelphia. A car having a new two-motor equipment, geared for about 25 miles per hour, was supplied with lubricants consisting of 25-lb. Keystone motor grease for the motor and axle bearings at one end, and an equal weight of the ordinary stock grease that has hitherto been in use by the road for these bearings at the other end. The car was then put into regular service. A recent report on the test stated that the entire 25 lb. of the ordinary grease and two-thirds of a second charge of 25 lb. of the same were used, whereas less than one-third of the original charge of Keystone grease had been consumed.

Installing Switches in Damp Walls.

The following communication has been received from the Hart Manufacturing Company, Hartford, Conn.:

"On page 826 of the issue of April 1 is an article in which the statement is made that when push-button switches are installed in wet plastered walls, 'they are subjected to a hardship



FIGS. 1 AND 2.—DAMP-PROOF PUSH-BUTTON SWITCH.

that they are little fitted to overcome.' This statement is in error if applied to any 'Diamond H' switches in use, all of which are constructed to withstand dampness, both at the time of installation and for years afterward. Dampness does not terminate at the completion of a building, but remains in the walls for some months afterward and is absorbed during every damp spell. As a consequence, a switch not constructed to withstand dampness will have a short and unsatisfactory life. 'Diamond H' switches, installed as far back as 1898-9, are today working properly and, in fact, no installation of 'Diamond H' switches has ever been replaced for the reason stated.

"The article further says that where switches have been installed in wet walls and lasted for years, it was because they were made of 'all-cast parts,' which type required 'a man with a muscular thumb' to operate them. 'Diamond H' switches have never been made with cast parts or heavier mechanism than at present, and at all times could be operated with ease by anyone not affected with paralysis. As to the necessity of a special construction to enable a switch to be wired before the rough plastering is completed, this advantage exists only in theory, as 'Diamond H' push-button switches are so constructed that the mechanism is entirely enclosed by the porcelain base, making it impossible for plaster or foreign substances of any description to get into the working parts. This construction is found only in 'Diamond H' push-button switches, and in the article referred to their particular merits were overlooked."

Industrial and Commercial News

Commercial Intelligence.

THE WEEK IN TRADE.

There has been no improvement in the conditions of trade during the past week, although the tone continues to be very hopeful, and business men seem to be encouraged as to the immediate future. To sum up the situation of the early spring trade, it would be fair to say that it has been rather disappointing than otherwise. Commercially and industrially the return to normal conditions has been much more tardy than was anticipated at the beginning of the year. In the retail line business has been fair, and as a whole has been better than for the same period in 1908, but has been far behind that of 1907 and some of the years that immediately preceded it. The Easter trade was generally good throughout the North and West, was an average in the East and rather poor in the Southwest and Texas, where local conditions militated against it. The recent orders that have been received by wholesalers and jobbers have been very light, and continue to be merely of the filling in or emergency class. There seems to be no fixed determination on the part of outside merchants to lay in stocks for the future. There has been some business done in agricultural implements, in fertilizers and in all commodities that are strictly for farm use. This, however, is merely the seasonable business that is to be expected at planting time. The more favorable weather has increased to some extent the building business and trade in lumber, paints and kindred materials which enter into construction. While it is too early for the crop reports to cut much figure in trade conditions, the only Government report that has been made is rather discouraging, as it shows that the winter wheat crop is below the average, and indicates that the yield will be short. The iron, steel and coke trades are very quiet. There is little buying in pig iron, and, outside of structural material, very few orders are being placed for finished products. The condition of the coal trade is unsettled, owing to wage scale complications affecting the anthracite properties. While it is not likely that there will be any strike, as the miners appear to be unwilling to bring about such a condition, it seems evident that an agreement will not be reached very soon. The passage of the tariff bill through the House means little that is definite to trade, as it is the general opinion that it will be materially amended in the Senate. It is encouraging, however, to business men that the new measure has progressed thus far, and it leads to the hope that the final termination of the tariff matter will be speedy. One indication of returning confidence in general business conditions is the sudden activity in the diamond and precious stone market. The import of jewels for the month of March were nine times as large as they were for the same month a year ago, and the importers declare that there is more inquiry for diamonds at this time than there has been for the past 18 months. This is mentioned because there are many people who believe that the diamond trade is a barometer of the general commercial sentiment. Diamonds are not bought when the general feeling of business men is one of depression. Collections continue to be only fair, in spite of the easy money market. Business failures for the week ended April 8 were 227, against 204 of the previous week, 258 for the same week in 1908, 194 in 1907, 161 in 1906 and 196 in 1905.

THE COPPER MARKET.

The immediate feature of the copper market is the report of the Copper Producers' Association which was made public April 12. This report shows that the stock of marketable copper on hand in the United States March 1, according to the previous report, was 173,284,248 lb.; that the production of marketable copper from domestic mines and imports during the month of March was 117,058,661 lb.; that the deliveries of marketable copper for export and consumption during the month were 108,063,007 lb., leaving on hand April 1 a surplus of 182,279,902 lb. This indicates an increase during the month of 8,995,654 lb., which is very much smaller than had been anticipated. The discrepancies between these figures and the figures of outside statisticians are mostly in the deliveries for export and consumption. The reports of the United States Custom House show that there were exported during the month of March 46,645,760 lb., which would indicate domestic takings of 61,417,247 lb. It is claimed, however, that the exports were practically 10,000,000 lb. greater than were shown in the Government figures. If this claim is correct, the takings for domestic consumption amounted to about 51,500,000 lb., which is a very considerable increase over the average for the first two months of the current year. It is estimated that the average takings since Jan. 1, have been about 36,000,000 lb., and, as it is well known that the users of copper are not any more actively employed at the present time than they have been during the earlier months of the year, it is evident, if the figures given out by the association are correct, that stocks have accumulated in consumers' hands. If this is the case, the reduction in the ratio of increase of the surplus in the hands of producers is offset by the increase in the hands of consumers. It makes little difference to the market where the surplus is carried so long as the surplus continues to grow. During the past week the market has been extremely dull, owing to the fact that domestic buying amounted to practically nothing, and that the London market was closed for three business days. Prices have remained unchanged, and there seems to be little evidence of any pressure on the part of either producers or selling agencies to make sales. So far as is known, no material concessions have been made from quoted prices. Exports have been quite liberal since the first of April, averaging about 1000 tons a day. Up to and including April 8 the total exports had amounted to 7234 tons. Quotations on the Metal Exchange April 12 were:

Lake	12⅞@13
Electrolytic	12½@12⅝
Casting	12⅜@12½

London prices April 8 were as follows:

	Noon. £	s	d	Close. £	s	d
Standard copper, spot	57	0	0	.....		
Standard copper, futures	57	13	6	.....		
Market		Easy		.....		
Sales of spot				200 tons		
Sales of futures				500 tons		

Extreme fluctuations for this year:

	Highest.			Lowest.		
Standard	.....			.....		
Lake	14.55			12.55		
Electrolytic	14.25			12.12½		
Casting	14.12½			12.00		
London, spot	£64	2	6	£54	12	6
London, futures	64	17	6	55	10	0
London, best selected	67	15	0	59	0	0

PROPOSED INCREASE IN CARBON TARIFF.—The new tariff bill as reported by the Finance Committee of the United States Senate provides that electric light carbons shall pay a duty of $7 per thousand feet. This is not only an increase in duty over the rate of 35 per cent ad valorem, which was the provision of the Payne bill that passed the House last week, but is an increase also over the present rate of duty of $9 per thousand pieces, as provided in the Dingley bill. Under the Dingley law the importation of carbons was never a revenue-producing business. The average return to the Government on this account was between $100,000 and $125,000 per year. At a matter of fact, the $9 per thousand rate practically prevented the competition of imported carbons with the American manufacture. This was true in spite of the fact that importers brought in the majority of their carbons in double lengths, and in some instances in triple lengths, in order to avoid the high duty. The main item, which has been imported, are the carbons for enclosed arc lamps. In use these run 9½, 10 and 12 in. in length, and the consumption of the latter length is about 70 per cent of the total. By importing in 24-in. lengths, and cutting in two pieces, and by importing in 28½-in. lengths and cutting in three pieces, the importers have been able to reduce their duty to about $4 per thousand carbons. This makes no allowance for breakage, which increases as the length of the

carbons increases, nor for the expense of cutting. Owing to the difficulty of making straight carbons in these unusual lengths, only three firms in Germany have been able to supply them. If the bill proposed by the Senate committee becomes a law, it will mean that the duty upon these enclosed arc carbons will be increased from an average of $4 or $4.50 per thousand to $7 per thousand of 12-in. carbons. The result of the law will be that the duty on enclosed arc carbons, of which there are, roughly estimated, 40,000,000 or 50,000,000 used in the United States every year, 5,000,000 to 7,000,000 of which are imported, will be increased from the present rate from 40 to 50 per cent. This does not appear in the provisions of the bill, because 90 per cent of all the imports of those carbons have been in extra lengths. Comparing the present bill with the Dingley law it would seem that there has been a reduction of 20 cents per thousand; the insertion of the word "feet," however, practically amounts to an increase of the duty as stated above. But few enclosed arc carbons have been imported in 12-in. or less lengths, so that but few of the importers have paid the full duty on regular lamp lengths. There has been no importation of carbons for the ordinary open arc lamps. These are pressed carbons and can, it is asserted, be made to sell for from $5 to $8 per thousand. The $9 duty has, therefore, been absolutely prohibitive. Carbons for enclosed arcs have been sold in this country under the present protection at from $20 to $26 per thousand. The increase in duty will mean an increase in this price, and the central stations which have public lighting contracts will be directly affected. In the flaming-arc business, which has recently been developing rapidly, the new law means also a large increase over the present rates. The increase, however, will not be so great as it would have been on some of the high-class carbons under the 35 per cent provision of the Payne law. Flaming-arc carbons are quoted in pairs for the reason that the positive and negative carbons have different values; on this account they are sold in pairs, and quotations and duty are all considered in pairs. Of the importations within the past few months about 65 per cent of the flaming-arc carbons have been in the 24-in. or 600-mm lengths, and 35 per cent in the 16-in. or 400-mm lengths. The percentage of the longer lengths is constantly increasing, from the fact that there is a greater demand for longer burning lamps. A thousand pairs of carbons of the 24-in. length have heretofore paid a duty of $18. It is estimated that under the Payne law provision of 35 per cent ad valorem, these carbons would have to pay a duty of $24.85, and under the provisions of the Senate bill they would pay a duty at the rate of $7 per thousand feet or $28, as a thousand pairs of 24-in. carbons would measure 4000 lin. ft. The duty on 1000 pairs of 16-in. carbons under the present law has been $18; under the Payne law at 35 per cent ad valorum it would have been about $16.80, and under the provisions of the proposed Senate bill it will be about $18.66. In others words, the Senate bill increases the duty on all flaming-arc carbons that are imported, because there is none which comes in shorter than the 16-in. length. To figure the matter down a little more closely, the importers now pay upon 24-in. carbons $9 duty upon 24,000 in., or 2000 ft. Under the proposed Senate bill they would pay upon this same shipment $14, as the new rate is $7 per thousand feet. On 16-in. carbons the importers now pay $9 for every 16,000 in. As 16,000 in. is 1333 ft. the importer will pay, if the Senate bill, of $7 per thousand ft., becomes a law, $9.33 for the same import. The importers claim that if the Senate law becomes effective it will materially curtail their business, and will, in consequence, add to the present price of carbons, thereby affecting the operating cost of every central station which does lighting. They also claim that the substitute offered by the Senate for the Payne bill is directly opposite to the weight of testimony that was given upon the question of carbon manufacture before the Ways and Means Committee of the House. Speaking of the present situation, Hugo Reisinger, who imports the largest proportion of foreign carbons used in this country, has this to say: "We understand that this proposed increase of duty which the Senate bill offers, is directly the result of political influence. Myron T. Herrick, ex-Governor of Ohio, and a very influential politician, is one of the vice-presidents of the carbon trust. It is probably not necessary to say more than this in regard to the Senate provision. Under the present law the percentage of imports has only been from 10 to 15 per cent of the total of carbons used. This shows that the carbon trust has been able to sell 85 or 90 per cent of all of the carbons, and these have sold at what I consider an exorbitant profit. Carbons for standard enclosed arc lamps, according to my estimates, do not cost the trust more than $8 per thousand to manufacture. They are sold at from $20 to $24 per thousand, according to the size of the orders, and this enables the trust to pay dividends upon an excessive capitalization. We maintain that the imported article is superior in quality to the domestic manufacture, but that the enormous duty has made it almost impossible for the foreign articles to compete. If this proposed law is enacted it will be even more difficult for the importer to compete with the National Carbon Company. In his testimony before the Ways and Means Committee, the secretary of the National Carbon Company admitted that it had absolute control of the carbon trade, and that it was therefore practically a trust. I think it is up to the central station managers of the United States to get busy and prevent the enactment of this Senate law. When it comes down to the last analysis, the central station man is the one who pays the excessive price. Of course, the tax payers and the public eventually pay, but it is upon the central station men that the burden will fall most heavily. It is difficult to make the legislators understand the effect of the introduction of the words 'per thousand feet.' This is really the catch phrase of the entire paragraph on carbons. If the central station men wish to prevent the passage of this law they should write to their Senators at once."

IMPORTANT WATER-POWER DEVELOPMENT IN IDAHO AND MONTANA.—The Northern Idaho & Montana Power Company, organized under the laws of Delaware, with authorized capital stock of $6,500,000, divided into $2,500,000 preferred and $4,000,000 common stock, and an authorized bond issue of $10,000,000, is operating electrical properties in eastern Washington, northern Idaho and western Montana. It owns a number of electrical public-service utilities, and is now distributing electric light and power, and it proposes to develop several water powers. The water powers which it now controls are capable of development in excess of 100,000 hp at minimum flow. They are on the Big Fork River, Moyie River and Pend o'Reille River, formerly called Clark's Fork of the Columbia River. Plants are operated at Newport, Wash.; Sand Point, Idaho; Polson, Mont., and Kalispell, Mont., and the company is negotiating for others. The company is entirely financed and is a going concern. It hopes ultimately to be one of the largest hydro-electric power concerns in the Northwest and in furthering it own interests it will also be an important agency in developing the country. The company was promoted and financed by H. M. Byllesby & Company, engineers, and Howard, Simmons & Company, bankers, of Chicago. Mr. Otto E. Osthoff, vice-president of H. M. Byllesby & Company, has just returned from an extended visit to the territory in which the company will operate. The largest of the existing water-power plants is that of Kalispell, where generating machinery having a rating of 1500 hp is now in operation, the ultimate rating of the present station being 8000 hp.

ELECTRICAL APPARATUS FOR SEWAGE PLANT.—Messrs. Dixon & Smith, engineers, Wright Building, St. Louis, Mo., will act as consulting engineers to revise the plans for the East St. Louis sewage pumping plant. The plant will consist of seven centrifugal pumps operated by gas engines, the total capacity being 1800 hp. A small electric plant will be installed to operate the crane, valves and accessories. The main building is 136 ft. x 38 ft. Bids will be asked for in about 10 days by the engineers for O. T. Dunlap & Company, who have the contract for installing this work.

TELEPHONE GROWTH IN ALBERTA.—There is rapid development in the construction of telephone lines in the Province of Alberta under the direction of the department of public works. It is estimated that within the present year there will be 800 miles of new telephone lines constructed. The mileage constructed last year amounted to this much, and the demands are as urgent at the present time as they were at the beginning of 1908. If all the demands could be granted there would probably be 3,000 miles constructed during the year.

NORTHWESTERN RAILWAY ELECTRIFICATION.—The Northern Pacific Railway Company is conducting preliminary investigations looking to the electrification of the greater part of its Montana division. It is said that negotiations are already pending with the Madison River Power Company for furnishing energy for the operation. It is also said that the St. Paul Railroad has decided to electrify its Montana division and is only awaiting the development of the extensive power project at Great Falls, Mont.

MIETZ OIL ENGINES.—August Mietz, 128-138 Mott Street, New York, has put in operation at the municipal water works of Newburyport, Mass., a pumping engine which is claimed to have made a record for economy hard to beat. The engine is a horizontal Mietz & Weiss 40-hp oil engine and is operated night and day. The report of the engineer at the station shows that the engine consumes 25 pints of oil (Gulf Refining Company) per hour, which has been purchased delivered at the station at 2¾ cents per gallon. In other words, the fuel cost of the plant is about 8½ cents per hour, or a little more than $2 per day of 24 hours. The pump lifts 14,000 gal. of water under 150 ft. head for every gallon of oil consumed. The August Mietz Company has also recently sold a number of its oil engines for service in connection with electrical installations. J. Ogden Armour has purchased for his estate at Melody Station, near Chicago, two 90-hp four-cylinder oil engines, direct connected to 60-kw Sprague generators, and one 40-hp engine connected to a 25-kw generator. This installation is to be used for furnishing power, running pumps and providing current for lights. The two heavier engines are duplicated to provide for emergencies and to take care of extra heavy loads. The Armour Packing Company has also recently purchased six 50-hp oil engines for use in its fertilizer plants in various towns in Florida.

NEW YORK AND BROOKLYN BRIDGE SUBWAY LOOP.—Construction on the Manhattan end of the Brooklyn subway loop is progressing rapidly, and it is promised that the work will be completed within a few months. It has been held up at the Brooklyn Bridge terminal by the city's delay in adopting plans for its municipal building. Other parts of the line, however, have progressed with rapidity. So far, however, there has been no bidder for the operation of the road when it is completed. It is thought that the Bradley-Gafney-Steers Company will ask for the right to operate the new subway if it is granted its franchise down the east side, for which application has been filed with the Public Service Commission. The Brooklyn side of the loop system, that is, the road through the Flatbush Avenue extension to the new Manhattan Bridge, has never been taken up by the city, and no arrangements have been made for any construction in that section. For this reason the Public Service Commission has taken the ground that to ask for operating bids at this time would mean that the Brooklyn Rapid Transit would be debarred from bidding.

ALUMINUM DEVELOPMENT IN GREAT BRITAIN.—The British Aluminum Company has put in operation its plant at Kinlochleven, on which more than $5,000,000 has already been spent, having been able to begin the production of aluminum at the new plant six months earlier than was at first anticipated. The extra haste in completing this plant was due to the dissolution, last September, of the aluminum pool. The breaking up of this combine resulted in a decrease in aluminum prices from $1,000 a ton, which prevailed to in 1907, to about $300 a ton. This makes it necessary for the company to rely upon increased sales in order to make a profit. It is expected that the present plant will produce, eventually, 30,000,000 lb. of aluminum annually. The company will issue $1,200,000 of bonds for one of its subsidiaries and will increase its own bond issue from $500,000 to $5,500,000.

NEW HAVEN RAILROAD ELECTRIFICATION.—At a meeting of the board of directors of the New York, New Haven & Hartford Railroad Company on April 9 the plans for the electrification of the division between Stamford, Conn., and New Haven were thoroughly discussed, but action was indefinitely postponed. Owing to the large expense which the work would entail, it was decided to defer taking the matter up until the normal earnings of the road had been restored. The present power plant at Coscob, Conn., is sufficiently well located to handle the operation of this district, but its size would have to be materially increased. It is said that the estimates for the proposed electrification and increase in generating equipment amount to about $15,000,000.

66,000-VOLT WINNIPEG POWER DEVELOPMENT.—Work has been commenced on clearing the right-of-way for the transmission line of the new Winnipeg electrical power development. This is 100 ft. wide and the total length of the line to Point du Bois is 75.5 miles. Rapid progress is being made on the two large cofferdams at the latter place. Contracts have been let to the Locke Insulator Manufacturing Company, of Victor, N. Y., for the line and special insulators, the estimated cost of which is $14,625. A small contract has been also awarded to the Stuart Machinery Company, of Winnipeg, for a machine shop equipment. The engineers for the work are Messrs. Smith, Kerry & Chace.

EXTENSION FOR MILLIKEN BROTHERS.—Judge Holt, of the Federal Court of New York, has granted an extension of 60 days to the receivership of Milliken Brothers, the structural steel concern. The application of the receivers shows that the steel trade is in a very demoralized condition. The low prices and sharp competition have brought about a condition of affairs which the receivers say is worse than at any time since the receivership began. The receivers announce that the company has been awarded the contract for the iron work on the immense building of Gimbel Brothers at Sixth Avenue and Thirty-second Street, in New York.

TRACTION BRAKES FOR BROOKLYN RAPID TRANSIT.—President Edwin W. Winter, of the Brooklyn Rapid Transit Company, has notified the Public Service Commission that he has made a contract with the Westinghouse Traction Brake Company for the installation of its system of traction brakes upon the elevated lines in Brooklyn. This action comes as the result of an investigation undertaken about a year ago by the Public Service Commission on the subject of brakes on the Brooklyn Rapid Transit elevated lines, as the commission was of the opinion that the safety of the public demanded a change in the system of brakes.

NEW OAKLAND, CAL., ELECTRICAL PLANT.—The Central Oakland Light & Power Company has been incorporated with a capital stock of $1,250,000, and will at once begin work on a plant to supply electric light, power and steam heat in Oakland. Among the incorporators is Mr. A. N. Hunt, who built the great Spreckels San Francisco electric lighting plant.

JERSEY ROADS BUY NEW EQUIPMENT.—The Public Service Railway Company, with headquarters at Newark, N. J., has recently purchased from the General Electric Company 6500 kw in rotary converters and 3500 kw in transformers. Switchboard equipment was also purchased. The company also purchased one 2000-kw turbo-generator for its Camden station.

BOGOTA ELECTRICAL PLANT.—A consular report from Bogota, Colombia, states that a hydro-electric plant to supply electric light and power to Bogota is under consideration. The city offers $25,000 per annum for lighting its streets, the cost of the street lighting installation being estimated at $89,000.

Financial Intelligence.

THE WEEK IN WALL STREET.

After the Easter holiday the New York stock market returned to business with an accession of activity, and with higher prices. The tone of the market has been so strong for several weeks that, although there have been temporary recessions, a permanent advance has been generally anticipated. For this reason, the majority of the people who deal in stocks regularly were willing to go on their holidays long of shares. There was no evidence that accounts were closed out immediately preceding the holiday. When the market opened on April 12 there was some uncertainty, owing to the fact that Easter Monday is a holiday in London, and there was no line for traders to go by from the transatlantic market. Almost immediately, however, a buying movement set in, and during the day considerable advances were recorded on almost every one of the active stocks. Atlantic Coast Line and Louisville & Nashville were especially strong. This was due to reports that were circulated that the earnings of these companies had so rapidly increased that it would be almost impossible to avoid an increase in the rates of dividends. The general sentiment in the stock market is very optimistic. This is not due to any actual increase in commercial business, but owing to the fact that in all lines there is a belief that normal business will be reached within a very short period. It is now expected that the tariff will be finally settled within a few weeks, and this will establish a basis upon which summer and fall commercial transactions can be made. The railroads are already reporting marked increases in their net earnings, and, while the industrial companies are not as yet very busy, the general sentiment among their managers is that it will only be a short time until orders will be almost overwhelming. The money market continues to be very easy; bonds are in good demand, and the banks have plenty of cash ready to lend on every reasonable proposition. Call rates on April 12 were 1¾ @ 2 per cent, 90-day paper was 2½ @2¾ per cent. The quotations in the table are those of the close April 12.

NEW YORK.

	Apr. 3.	Apr. 12.	Shares sold.		Apr. 3.	Apr. 12.	Shares sold.
All.-Ch.	15⅛	15	400	Int.-Met., pfd.	43⅛	43¼	49,300
All.-Ch., pfd.	47⅜	47¾	2,000	Mackay Cos.	74¼	78	7,150
Amal. Cop.	77⅞	78⅜	95,815	MackayCos.,pfd.	71	74	1,500
Am. D. T.	29*	29½	——	Manhattan Elev.	144*	145*	100
Am. Loc.	56	55⅛	6,900	Met. St. Ry.	25	22*	300
Am. Loc., pfd.	114⅞*	114⅞	——	N.Y. & N.J.Tel.	119½	122	300
Am. Tel. & Cbl.	76*	76	14	Steel, com.	51½	52½	363,238
Am. T. & T.	131⅞	137½	79,183	Steel, pfd.	113⅞	115	10,877
B. R. T.	77⅜	77⅜	65,930	W. U. T.	67	69½	8,000
Gen. Elec.	159⅝	159¾	12,375	West'h., com.	84½	84¾	11,800
Int.-Met., com.	14⅞	14⅞	15,075	West'h., pfd.	115*	120	480

PHILADELPHIA.

	Apr. 3.	Apr. 12.	Shares sold.		Apr. 3.	Apr. 12.	Shares sold.
Am. Rys.	46	46*	——	Phila. Elec.	11¾	12⅛	——
Elec. Co. of A.	12½*	12½	——	Phila. R. T.	29⅞	32¾	——
Elec. Stor. B'ty.	44¾	45	——	Phila. Traction.	92½*	92½	——
E. S. B'ty, pfd.	49*	49*	——	Union Traction.	55⅜	57	——

CHICAGO.

	Apr. 3.	Apr. 12.	Shares sold.		Apr. 3.	Apr. 12.	Shares sold.
Chi. City Ry.	187*	180*	——	Chi. Tel. Co.	133*	133	——
Chi. Rys., Ser.1.	110*	110	——	Met. El., com.	19*	19*	——
Chi. Rys., Ser.2.	41*	40⅛	——	Nat'nal Carbon.	84	85½	——
Com. Edison.	112*	112⅛	——	Nat. Carb., pfd.	119*	120*	——
Chi. Subways.	27½*	27½*	——				

BOSTON.

	Apr. 3.	Apr. 12.	Shares sold.		Apr. 3.	Apr. 12.	Shares sold.
Am. Tel. & Tel.	131⅞	137¾	——	Mex. Tel.	3	2¾*	——
Cum. Tel.	128*	130	——	Mex. Tel., pfd.	6*	6*	——
Edison El. Ill.	258¼	260	——	N. E. Tel.	132½	134½	——
Gen. Elec.	160	160	——	W. Tel & Tel.	7*	9½*	——
Mass. Elec. Ry.	14¾	14½	——	W. T. & T., pfd	75⅜	83¾	——
Mass. E. R., pfd	72¼	72¼	——				

*Last price quoted.
Shares sold are for four days, April 5 to April 8.

DIVIDENDS.

Albany Home Telephone Company, quarterly, 1 per cent, payable April 20.

American Light & Traction Company, preferred, quarterly, 1½ per cent; common, quarterly, 2 per cent, both payable May 1.

Cape Breton Electric Company, Ltd., preferred, semi-annual, 3 per cent, payable May 1.

Columbus (Ohio) Railway Company, preferred, quarterly, 1¼ per cent, payable May 1.

East St. Louis & Suburban Company, preferred, quarterly, 1¼ per cent, payable May 1.

Edison Electric Illuminating Company, Boston, quarterly, 2½ per cent, payable May 10.

Electric Bond & Share Company, preferred, quarterly, 1¼ per cent, payable May 1.

Electrical Securities Corporation, preferred, semi-annual, 2½ per cent, payable May 1.

Milwaukee Electric Railway & Light Company, preferred, quarterly, 1½ per cent, payable April 30.

Montreal Street Railway Company, quarterly, 2½ per cent, payable May 1.

People's Gas Light & Coke Company, Chicago, quarterly, 1¾ per cent, payable May 25.

Twin City Rapid Transit Company, Minneapolis, common, quarterly, 1¼ per cent, payable May 15.

HUDSON RIVER POWER COMPANIES.—A comprehensive reorganization plan for the Hudson River Power Companies, which comprise eight separate incorporations, has practically been agreed upon by the various bondholders' committees, which have been working on the matter. The probabilities are that the properties will be bought in at foreclosure sale and turned over to one central organization. Application has been made by the Hooper committee for the foreclosure of the mortgages on the Hudson River Electric Power Company, the Hudson River Water Power Company and the Hudson River Electric Company. These three companies hold $9,202,000 of the entire $11,010,500 outstanding bonds of the entire eight companies. The request for foreclosure on the other five companies will probably be made at once. In the reorganization there will necessarily be a considerable scaling down of the present bond issues. The actual value of the physical properties as estimated by Stone & Webster, not including the rights of way, is $6,234,000, which is nearly $5,000,000 less than the amount of bonds outstanding. The Hudson River Companies will undoubtedly require a considerable amount of new money to put the properties into successful operation. Additional transmission lines will have to be constructed to link together the isolated plants in order to make a successful working unit of the entire system.

RAILWAY PROMOTERS REFUND.—Thomas F. Ryan, P. A. B. Widener, Thomas Dolan and the estates of William C. Whitney and William L. Elkins have paid back to the Metropolitan Securities Company the sum of $692,292. This is the amount which the promoters of the Metropolitan system paid to Anthony N. Brady "for distribution" at the time of the purchase of the Wall and Cortlandt Street Ferries Railway Company. Of this amount $245,681 was repaid by the Whitney estate, which was the amount Mr. Whitney originally received. The suit brought by the Metropolitan Securities Company has been discontinued. The fact that this large amount had been paid to the promoters was brought to light through an investigation of the Public Service Commission.

NEW YORK CAN BUILD NEW SUBWAYS.—According to the report of General Benjamin F. Tracy, who was appointed by the Supreme Court last June as a referee to investigate the condition of New York City's public debt with a view to ascertaining whether additional bonds could be issued to pay for new subways, the city's debt limit has not yet been reached by $106,205,714. General Tracy's report makes all the deduction which he considers necessary from the city's bond issues, and in his opinion the margin is as above indicated. The report is made in connection with an injunction proceeding against the building of the Fourth Avenue Subway in Brooklyn. The case will be carried to the Court of Appeals.

SIXTH AVENUE RAILROAD COMPANY.—President Frank Curtiss, of the Sixth Avenue Railroad Company of New York City, has sent a notice to the stockholders informing them that the regular dividends of the company will be deferred. This is done, it is said, on account of the unsettled state of traction affairs on Manhattan. The Sixth Avenue Railroad was leased in 1892 to the Houston, West Street & Pavonia Ferry Company for 800 years at a rental equivalent to 7 per cent on its stock. The Pavonia Company was taken over by the Metropolitan Street Railway Company, and the Sixth Avenue has therefore been a portion of the Metropolitan system. It is not stated that the company has shown any decrease in business, but the dividends are suspended until the complications are cleared away.

WASHINGTON RAILWAY & ELECTRIC COMPANY.—The gross earnings of the Washington Railway & Electric Company for the year 1908 were $3,720,573, as compared with $3,385,748 the previous year. The net earnings of the company, after making deductions which were applied to subsidiaries, amounted to $616,057, which equals 5 per cent upon the preferred stock and almost 3 per cent upon the common stock.

THE MACKAY COMPANIES.—It is stated by an official of the Mackay Companies that the earnings at the present time are sufficient to warrant an increase in the dividend on the common stock from 4 to 5 per cent. It is not likely, however, that such an increase will be ordered, from the simple fact that the management, which has always been very conservative, prefers to further increase the surplus fund.

WESTINGHOUSE NOTES ARRANGED FOR.—Robert Mather, chairman of the board of directors of the Westinghouse Electric & Manufacturing Company, is said to have made satisfactory arrangements in his recent trip abroad to take care of the $3,000,000 short-term notes of the company which were placed in Paris in 1907. These notes were issued shortly before the panic. In order to devote his entire time to the Westinghouse company, Mr. Mather has resigned from the presidency of the Rock Island company.

TRACTION PROFITS FOR CHICAGO.—The city of Chicago was paid more than $1,300,000 last week as a result of its partnership with the Chicago City Railway Company and the Chicago Railways Company. This money represents 55 per cent of the net earnings of the two surface lines during the fiscal year which ended Jan. 31, 1909.

MAY MAKE AN OFFER FOR STEINWAY TUNNEL.—It is said the Interborough Rapid Transit Company is preparing to make a new offer to the city for a franchise for operating the Steinway tunnel. President Theodore P. Shonts says that his company is willing to carry passengers from Queens Borough and give free transfers to the subway system.

DENVER CITY TRAMWAY BONDS.—Clark, Dodge & Company, New York, and E. W. Clark & Company, Philadelphia, are offering to the public $1,848,000 5 per cent first and refunding sinking fund mortgage bonds of the Denver City Tramway Company. The bonds are due Nov. 1, 1933. They are offered at 95 and interest.

INTERNATIONAL SMELTING & REFINING COMPANY.—The $10,000,000 of stock to be issued by the International Smelting & Refining Company was so heavily oversubscribed that in some instances subscribers had to be cut down 75 per cent, and many applications were ignored entirely. The rush for this stock was particularly eager on account of the fact that the subscribers to this issue will hereafter have the right to subscribe to the $40,000,000 additional stock which is authorized in the company's incorporation. It is semi-officially announced that the company will go on a semi-annual dividend basis in May or June of this year, and that the earnings of the company for the current year will be close to $1,000,000, or 10 per cent on the issue of stock, all of which will be derived from the Raritan Refining Works. The company has made a contract for securing the site for its new smelter, which will be built at the mouth of Pine Canyon, Tooele County, Utah. The structural steel for its construction has already been ordered, and it is promised that work will be pushed to a very speedy completion.

NORTH MOUNT VERNON LINE SOLD.—The only railroad owned by the New York City Railway Company was sold at auction at White Plains on April 8. The line was the old North Mount Vernon Railway, which was 1.57 miles long, and owned two cars, which were so badly in need of repairs that they could not be operated. The line was sold under order of the court by the receiver of the New York City Railway Company. It was bought in by John Johnston, of Brooklyn, for $500, which covered the franchise, tracks, wires, poles and other property, and the purchaser is also liable for $25,000 in franchise taxes and assessments, which he agreed to pay. Mr. Johnston declined to make any announcement as to his purpose in buying the road, but it is presumed it is for some of the other Bronx properties, as the line is only available as a connecting link.

AMERICAN GAS & ELECTRIC COMPANY.—The earnings of the American Gas & Electric Company have been rapidly gaining within the past few months. For the three months which ended Feb. 28 the surplus earnings were $96,210; this is at the rate of 15.39 per cent per annum on the common stock after dividends of 6 per cent had been paid on the preferred. It is stated that within the past year the total number of customers of the sub-companies has increased more than 20 per cent. The company recently has been pursuing the policy of expansion and acquisition. It has taken over the Forest City (Pa.) Electric Company and also the Lackawanna Valley Electric Light & Power Company, of Carbondale, Pa.

AMERICAN LIGHT & TRACTION COMPANY.—At the meeting of the directors of the American Light & Traction Company, April 7, the regular quarterly dividends were declared, and the board confirmed the action of the executive committee in voting to pay on Nov. 1 an extra stock dividend of 10 per cent to holders of the common stock. This was the first meeting of the new board of directors, and Emerson McMillan, formerly president of the company, was elected to the newly created position of chairman of the board. A. P. Lathrop was elected president, and J. M. McCarthy was chosen vice-president and treasurer. Marion McMillan was also elected vice-president and assistant secretary.

TRI-CITY RAILWAY & LIGHT COMPANY.—The annual report of the Tri-City Railway & Light Company, Davenport, Iowa, for the year 1908 shows gross earnings of $1,819,077, an increase of $36,721 over the previous year. Speaking of the condition of the company, Joseph F. Porter, the president, says that while the gross earnings only show an increase of 2.06 per cent, the net earnings, owing to improvements, increased efficiency and economies, have increased 15.35 per cent. The surplus at the end of the year was sufficient to pay a 6 per cent dividend on the preferred stock, leaving a balance of $93,119, which was equal to more than 1 per cent on the common stock.

NEW YORK & QUEENS ELECTRIC LIGHT & POWER.—The directors of the New York & Queens Electric Light & Power Company have made a proposition to the stockholders providing for an issue of $1,500,000 in bonds, to provide for further extensions and improvements. It is said that the future development and growth of the Borough of Queens demand these extensions. The majority of the stockholders have already given their consent. There is also a proposition before the stockholders to place a general and refunding mortgage on the property and franchises to the amount of $25,000,000, which will bear 5 per cent.

HUDSON COMPANIES DIRECTORS.—The board of directors of the Hudson Companies, holding company for the Hudson & Manhattan Railroad Company, have elected Dumont Clark, president of the American Exchange National Bank; A. A. Tilney, connected with the firm of Harvey Fisk & Sons, and Charles Francis Adams 2d, of Boston, Mass., directors to succeed Gardner M. Lane, Cornelius Vanderbilt and Andrew Friedman, who recently resigned from the board on account of their connection with the Interborough Rapid Transit Company. All three of the new directors are well known in the financial world.

MICHIGAN-LAKE SUPERIOR POWER COMPANY.—More than 99 per cent of the first mortgage bonds of the Michigan-Lake Superior Power Company have been deposited with the bondholders' reorganization committee, but no steps have been taken looking toward foreclosure proceedings. The bondholders have been waiting until the company's right to divert water from the main channel into its private canal have been fully established. It is believed that this will be accomplished by the provisions of the recently adopted River and Harbor bill.

GENERAL RAILWAY SIGNAL COMPANY.—The annual report of the General Railway Signal Company for 1908 shows that the business of the company for the year was only about 40 per cent of that done in 1907. The net earnings were only $47,344, and after paying interest charges and depreciation, there was a deficit of $19,103. Not including the current business of 1908, the company reports that it has now on hand contracts aggregating $1,100,000, and the officials declare that there has recently been a revival of activity in their orders.

LONDON UNDERGROUND ELECTRIC.—The report for the month of February of the Underground Electric Railways of London shows an increase in net earnings of more than $30,000. For some months past the gross receipts of the company have been very satisfactorily increased, while the expenses have been curtailed a small amount. The net earnings for the first two months of the present year have been about $200,000.

REPORTS OF EARNINGS.

	Gross earnings.	Expenses.	Net earnings.	Charges.	Surplus.
Dallas Combined Companies:					
February, 1909	$94,588	$57,953	$36,635	.....	$7,863
February, 1908	84,135	56,927	27,258	.....	2,257*
Galveston-Houston Electric Company:					
February, 1909	82,552	53,388	29,164	.....	7,603
February, 1908	74,714	48,252	26,462	.....	6,048
General Railway Signal Company:					
Year 1908	260,663	213,319	47,344	$66,447	19,103*
Year 1907	453,073	240,200	212,873	209,011	3,862*
Kansas City Railway & Light Company:					
February, 1909	505,813	283,632	222,181	150,460	71,721
February, 1908	464,118	251,390	251,390	151,050	61,678
Minneapolis General Electric Company:					
February, 1909	96,189	36,047	60,142	.....	29,614
February, 1908	84,583	35,922	48,661	.....	17,649
Northern Texas Electric Company:					
February, 1909	82,660	48,090	34,570	.....	17,380
February, 1908	71,310	44,227	27,083	.....	12,648
Seattle Electric Company:					
February, 1909	379,691	230,038	149,653	.....	53,142
February, 1908	347,618	220,250	127,368	.....	42,565
Tri-City Railway & Light Company (Davenport, Iowa):					
Year 1908	1,819,077	1,069,316	749,761	490,294	259,467
Year 1907	1,782,356	1,132,392	649,964	398,343	251,621
Washington Railway & Electric Company:					
Year 1908	3,720,573	1,856,171	1,864,402	1,177,491	724,436
Year 1907	3,385,748	1,748,752	1,636,996	1,107,228	572,121

*Deficit.

GENERAL NEWS

Construction News.

BELLEVILLE, ARK.—A telephone company has recently been organized in Belleville to construct a telephone system and will erect about 40 miles of line. W. G. Page is president and J. W. Wilson manager of the company.

CARLISLE, ARK.—The Carlisle Rice Mill Company has awarded the contract for its proposed power plant for rice mill to the Southern Engine & Boiler Works, of Jackson, Tenn., which includes a 400-hp Corliss engine, high-pressure boilers, pumps, automatic engine and lighting plant.

EUREKA SPRINGS, ARK.—It is reported that the Cassville & Western Railway Company is planning to develop the water power of White River to be utilized to generate electricity for lamps and motors.

MAMMOTH SPRINGS, ARK.—Frank Hill, of Memphis, has accepted the franchise offered by the City Council and will establish an electric light plant, work on which will begin at once.

GILROY, CAL.—The City Council, it is said, has decided to advertise for bids to furnish the city with electricity to operate the municipal electric light system for a term of five years. The municipal electric light plant has not proven a profitable investment, and it has been decided that the city can purchase electricity cheaper than it can be generated at the municipal plant.

NEEDLES, CAL.—The Needles Light & Power Company has applied to the Town Council for an extension of one year in time in which to complete its plant, the extension to date from July 27, 1909.

OAKLAND, CAL.—The Board of Supervisors has granted the Home Telephone Company, of Alameda County, a 50-year franchise for the extension of its telephone system to any part of the county, in return for which the company is to pay $2,500 and furnish the county with 20 telephones free of charge.

RED BLUFF, CAL.—Notice of appropriation of 12,000 cu. in. of water in Mill Creek has been filed by Smith Crowder.

REDDING, CAL.—Notice of appropriation of 100,000 cu. in. of water in the Sacramento River has been filed by A. L. Leonard, of Red Bluff. It is understood that the appropriation is made in the interest of the Iron Canyon irrigation project.

SACRAMENTO, CAL.—The Great Western Power Company has made preparations for the construction of an extensive distributing system, in the island district of the Sacramento and San Joaquin rivers, between Sacramento and Stockton, from the main tower line at New Hope, to supply electricity for lamps and motors to the farmers on the reclaimed land.

SAN FRANCISCO, CAL.—The promoters of the proposed Stockton street car line will apply to the Board of Supervisors for an additional franchise to operate its cars from the junction of Bay and East streets to the Presidio. The new company also proposes to apply to the Harbor Commissioners for permission to operate a street railway on East Street from the junction of Bay Street to the Ferry Building. Frank D. Stringham represents the promoters.

CRESCENT BEACH, CONN.—The incorporation committee of the State Legislature has voted to report favorably on the application of Cruttenden Brothers, of Norwich, Conn., to incorporate as the Crescent Beach Power & Water Company for the purpose of supplying electricity and water to the cottages at Crescent Beach and Sound View.

JEWETT CITY, CONN.—The Legislature has passed the bill authorizing the Borough of Jewett City to furnish electricity outside of the borough limits.

THOMPSONVILLE, CONN.—Announcement has been made by the Northern Connecticut Light & Power Company that the price of electricity for lamps in Hazardville, Enfield and Thompsonville, beginning June 1, will be reduced from 18 cents to 15 cents per kw-hour, with a discount of 10 per cent on bills paid before the 10th of the month, which will reduce the price to 13½ cents per kw-hour, making the rate the same as in Windsor Locks.

WASHINGTON, D. C.—Bids will be received until April 30 by James Knox Taylor, supervising architect, Washington, D. C., for bronze railings and lamp standards for the east front of the Treasury Building, Washington, D. C.

WASHINGTON, D. C.—Bids will be received by the Bureau of Supplies and Accounts, Navy Department, Washington, D. C., until April 27 to furnish at the navy yards and naval stations the following supplies: Brooklyn, N. Y., or Mare Island, Cal., Schedule 1089—65,000 ft. solid double braided wire. Brooklyn, N. Y., Schedule 1099—Four 300-kw turbo-generating sets. Schedule 1103—Electrically driven reversible two-speed deck winch. New Orleans, La., Schedule 1110—Panel board and distribution cabinet, cable, wire, etc.; panel board connections, steel conduit, etc. Applications for proposals should designate the schedule desired by number.

JACKSON, GA.—The Central Georgia Power Company, of Macon, Ga., is contemplating extending its transmission lines to Jackson to furnish electricity for lamps and motors. W. J. Massee is president of the company.

TALLADEGA, GA.—The City Council has granted the Alabama Power Development Company a perpetual franchise in this city, removing the provision in its present franchise limiting its service in Talladega to the hydro-electric plant at Jackson Shoals, and permitting the company to supply electricity generated either by steam or water power. The company agrees to erect a high-tension transmission line immediately from the Anniston plant and eventually to connect the system with its proposed plant at Little River Falls in Cherokee County, where it is estimated that 20,000 hp can be developed. The Jackson Shoals plant, where about 300 hp at present is available, will be further developed and a dam built some distance below the present dam. The plans of the company call for an expenditure of about $3,000,000, of which $300,000 will be spent immediately. The construction of an electric railway connecting Talladega, Anniston and Gadsden is included in the project.

LUCILLE, IDAHO.—Surveys are being made of the property of the United Placer Company, located on the Salmon River near Lucille. The company proposes to develop the water power and install an electric plant and pumping station.

OROFINO, IDAHO.—The Orofino Electric Company is reported to have filed on additional water rights in Orofino Creek.

POCATELLO, IDAHO.—The Bear Lake Power Company will construct a new power house and install new equipment this spring. The Bannock Engineering Company, of Pocatello, will have charge of the engineering work.

CLAYTON, ILL.—The capital stock of the Clayton Farmers' Union Telephone Company has been increased from $1,000 to $2,500.

PETERSBURG, ILL.—The proprietors of the Petersburg electric light plant are planning to change the system from single-phase, 125 cycles to the three-phase, 60 cycles, which will require the installation of a 150 or 200 hp engine and a 150 or 200 kw alternator. R. H. Abbott is president and manager.

COLUMBUS, IND.—The Central Indiana Lighting Company has secured a site on White River, where it will erect a new power plant.

CRAWFORDSVILLE, IND.—The Home Telephone Company is in the market for material to construct two miles of conduits and for new leads and cables. The company will also install a new switchboard in its new exchange building now being erected.

INDIANAPOLIS, IND.—The Indianapolis Light & Heat Company has awarded the contract for the construction of a concrete dam in Fall Creek at Northwestern Avenue to Henry Maag & Company for $10,200.

LINTON, IND.—Local capitalists are contemplating the purchase of the municipal light plant, and if secured will buy a coal mine near and erect a large electric light plant, with a view of furnishing electricity to neighboring towns. They also propose to build electric railways to and in the coal fields and to Martinsville.

PORTLAND, IND.—The City Council, in order to facilitate collection of service bills, is offering a discount of 2 cents per kw-hour on all bills paid on or before the 15th of each month. Those who do not pay by the 25th are to be disconnected without notice. The new rate is 11 cents per kw-hour for the first 9 kw; 10 to 29, inclusive, 10 cents; 30 to 59 kw, inclusive, 9 cents; 60 kw and over, 8 cents. Rates for electricity for motors will be 10 cents per kw for the first 10 kw; for each additional kw, to and including 199, 7 cents; 200 to 399 kw, inclusive, 7 cents; 400 to 599 kw, inclusive, 6½ cents; 600 kw or more, 6 cents.

RICHMOND, IND.—Robert Ashe has been granted a franchise by the County Commissioners to erect transmission lines from this city to Liberty, to supply electricity to the latter place.

RUSHVILLE, IND.—Bids will be received until May 14 by the city of Rushville for furnishing engine, piping, alternating-current generator and exciter to be installed in the municipal electric light plant. Plans and specifications are on file at the office of S. G. Gregg, city clerk, and A. T. Mahin, superintendent of the municipal electric light plant. Harvey M. Cowing is mayor.

VINCENNES, IND.—Bids will be received until June 8 for lighting the streets of the city for a term of 10 years with 200 arc lamps of 2000 cp, with an all-night and every-night service. The contract is to take effect from April 29, 1910.

DANBURY, IA.—Plans are being considered to install a municipal electric light plant in Danbury to cost about $7,000.

MARSHALLTOWN, IA.—Plans are being made by the Iowa Telephone Association for the construction of a new automatic telephone system in Marshalltown, which will involve an expenditure of about $150,000. The wires are to be placed in underground conduits.

SIOUX CITY, IA.—The Sioux City Service Company has filed amendments to its charter, increasing the capital stock from $25,000 to $2,000,000.

FORT LEAVENWORTH, KAN.—Bids will be received by Captain William D. Davis, quartermaster, until May 10 for construction of addition to engineer's barracks, building No. 45, at Fort Leavenworth, and for making additions to the heating and electric lighting system. Full information and blank forms of proposal furnished on application at the above office, where plans and specifications may be seen; also in the offices of the chief quartermasters at Chicago, Ill.; Omaha, Neb., and Denver, Col.; depot quartermasters at Philadelphia, Pa., and St. Louis, Mo.; quartermasters at Columbus Barracks, Ohio, and Master Builders' Exchange, Kansas City, Mo.

FORT SCOTT, KAN.—The Fort Scott Gas & Electric Company has been reorganized and proposes to rebuild its power plant and improve the electric lighting system.

LAWRENCE, KAN.—The City Council has granted franchises to two separate railway companies to operate street car lines in Lawrence: one to C. C. Sullivan, representing capitalists from Dayton, Ohio, to operate railway in Lawrence, and Whitsed Laming was granted a franchise to operate an interurban railway through the town.

WATHENA, KAN.—The proposition to issue bonds for the construction of an electric light plant will be submitted to the vote of the people.

WINFIELD, KAN.—The Missouri & Kansas Telephone Company is contemplating the reconstruction of the telephone system in Winfield. All the wires in the business section of the city will be placed underground.

HARLAN, KY.—The capital stock of the Harlan Telephone Company has been increased from $2,500 to $4,100.

MILTON, KY.—An effort is being made among the farmers of Trimble County to organize a rural telephone company. It is expected that the local company will start with about 300 subscribers.

SANDY SPRING, MD.—It is reported that the Kensington Railway Company is preparing to construct an extension of its railway from Kensington to Sandy Spring, a distance of about four miles. An issue of $50,000 in bonds is contemplated to build the extension. Charles F. Brooke is president, and Allan Farquhar treasurer of the company, both of Sandy Spring.

BOSTON, MASS.—Superintendent Emerson, of the Street Department, has recommended that the city enter into a 10-year contract with the Edison Electric Illuminating Company for the same service that is now furnished by the company. By the terms of the new contract it is estimated that the cost of the service will be approximately $300,000 per year, about $75,000 less than the city now pays. The contract also provides for substituting the new magnetite lamp for the lamp now in use. The contract with the Edison company expired March 20, and the city has since been paying the rates that were in force under the old contract. Mayor Hibbard has signed the contract with the Edison Electric Illuminating Company for lighting the city for a term of five years for $380,000 per year. The contract was made with the understanding that it can be changed for a 10-year contract any time within the next six months. The present contract saves the city $55,000 per year.

DEDHAM, MASS.—The citizens have voted to make a contract with the Edison Electric Illuminating Company for lighting the streets of the city for a term of 10 years at a cost of $9,016 per year.

ESSEX, MASS.—It is reported that a large addition is to be built to the power station at Essex Falls. The plant furnishes power for the Boston & Northern Street Railway.

FALL RIVER, MASS.—The Fall River Electric Light Company is making arrangements to extend its underground system and has applied to the Board of Aldermen for permission to place underground conduits on several streets in the city.

LEYDEN, MASS.—An effort is being made to have the Greenfield Electric Light & Power Company extend its transmission lines to Leyden.

MARLBORO, MASS.—We are informed that W. G. Webber has purchased the interest of W. H. Emery in the Marlboro Electric Company. Mr. Emery has resigned his position as treasurer and manager of the company; Edward C. Mason has been elected treasurer, and C. S. Davis general manger. The business of the company will continue as heretofore. W. G. Webber is president.

SPENCER, MASS.—The Spencer Gas Company has submitted a proposition to the committee on street lights offering to furnish 40-cp tungsten lamps at $18 per lamp per year and arc lamps at $75 each per year. It also offered a sliding scale on the tungsten lamp, reducing the above prices somewhat on a five-year contract.

STERLING, MASS.—The Selectmen have decided to grant the Connecticut River Power & Transmission Company a franchise to erect its transmission lines over the highways in the town, in return for which the company agrees to furnish electricity at the rate of 2¼ cents per kw-hour, delivered to the center of the town. As yet the town is not ready to make use of the privilege.

UXBRIDGE, MASS.—The Uxbridge & Northbridge Electric Company is making arrangements to change its entire plant from single-phase to three-phase, and will soon install a new generator in the near future. A. G. Sias is superintendent.

WEST BOYLSTON, MASS.—Arrangements are being made by the Marlboro Electric Light Company to install the street lighting system in West Boylston, which will consist of 125 tungsten lamps.

WORCESTER, MASS.—The subcommittee of the joint standing committee on public buildings, appointed to investigate and report on the advisability of installing a municipal lighting plant in the basement of the city hall to furnish electricity for lighting the building, the plaza and part of the common, has reported against the proposition.

FLINT, MICH.—The Oak Park Power Company is planning to install a new generating unit in its plant.

HOUGHTON, MICH.—The City Council is reported to be considering the question of establishing a municipal electric light plant.

TWO HARBORS, MICH.—Preliminary steps have been taken for the organization of the Lake County Rural Telephone Company. Arrangements will be made with the Duluth & Iron Range Telephone Company for long-distance connections. E. E. Cavalin is secretary of the temporary organization.

CHISHOLM, MINN.—The Meseba Telephone Company is planning to install a new telephone exchange in Chisholm.

FERGUS FALLS, MINN.—At an election held April 6 the citizens voted to issue $5,000 in bonds, the proceeds to be used for extensions to the municipal electric light system.

WADENA, MINN.—The Village Council is making arrangements to establish a 24-hour service in connection with the municipal electric light plant.

MACON, MISS.—On April 6 the citizens voted to issue $20,000 in bonds for improvements to the municipal electric light plant. The proceeds will be used to install an additional electric generating unit and motor-driven pumps. The construction of a high-tension transmission line to Brooksville is also contemplated to supply that town with electricity. G. B. Baskerville, Jr., is superintendent.

CLARKSBURG, MO.—Plans are being considered to install an electric light plant in this town. Charles Knirnschild, of Clarksburg, is interested in the project.

CRYSTAL CITY, MO.—The Pittsburg Plate Glass Company has purchased a new motor generator set for its plant in this city. The company is planning to add considerable new equipment during the coming summer.

EAST ST. LOUIS, MO.—Surveys have been completed by the Wood River, East Alton & Bunker Hill Traction Company and rights of way and franchises secured for its proposed electric railway from Wood River to East Alton and Litchfield, a distance of 30 miles. It has not yet been decided when contracts will be awarded. J. T. Rudisell is president and general manager.

HELENA, MONT.—The Hauser Lake Dam, located near Helena, owned by the Helena Power & Transmission Company, is reported to have been washed out again, causing a loss of about $250,000.

LINCOLN, NEB.—Extensive improvements are contemplated by the Automatic Telephone Company to its system during this coming summer, which will involve an expenditure of about $200,000, of which $100,000 will be used to erect long-distance lines. An addition will be built to the main exchange building, and a branch exchange will be erected at Twentieth and Cherry streets.

SOUTH OMAHA, NEB.—Bids will be received by John J. Gillin, city clerk, until April 19 for furnishing electric or gas lamps and maintenance for the same for a term of 5 or 10 years, beginning Oct. 26, 1909; also for lighting the city hall, jail building and all other public buildings and places.

VALENTINE, NEB.—It is reported that C. H. Cornell, who owns water rights on the Niobrara River, is planning to develop the same, to be utilized to generate electricity.

MANHATTAN, NEV.—The contract for the erection of the transmission lines to Round Mountain and Manhattan is reported to have been awarded to Hill & Carpenter for $11,000.

ALLENHURST, N. J.—The Senate has passed the bill allowing the Borough of Allenhurst to sell its municipal electric light plant.

CAPE MAY, N. J.—The Cape May Light & Power Company has applied to the County Board of Freeholders for permission to erect transmission lines on the county roads to Erma, Burleigh, Rio Grande, Green Creek and to the Five Mile Beach resorts.

ORANGE, N. J.—The City Council has authorized City Engineer Fred T. Crane to secure estimates of the cost of installing a municipal electric light plant and to report at the next meeting of the Council.

TRENTON, N. J.—The Senate has passed the bill authorizing the Boards of County Freeholders to contract for the lighting of highways across meadow lands to seaside resorts.

BATH, N. Y.—The Bath Electric & Gas Light Company has decided to re-establish a day service for both lamps and motors, beginning May 1. The service was discontinued four years ago and has been the main issue between the electric light company and the Village Trustees relative to renewing the street lighting contract and was the cause of the organization of the Citizens' Electric Service Company, which has tried for two years to get into condition to assume the street lighting contract in competition with the present company.

BROOKLYN, N. Y.—J. J. Boughman, treasurer and general manager of the South Flatbush Street Railway, states that the company expects to commence work on the construction of its proposed street railway from the Brighton Beach line of the Brooklyn Union Elevated Railroad, at Avenue Q to Avenue Q and Flatbush Avenue, Brooklyn, three miles in length. Two cars will be operated. Electricity for operating the cars

will be rented from the Brooklyn Rapid Transit Company. L. S. Sadler, of Carlisle, Pa., is president, and J. C. Langdon, 180 Montague Street, Brooklyn, secretary of the company.

BUFFALO, N. Y.—The plant of A. Nowak & Son, Buffalo, which was destroyed by fire last fall, is being rebuilt at a cost of about $100,000. The entire plant will be operated by electricity generated by Niagara power.

BUFFALO, N. Y.—The Board of Aldermen has adopted the resolution authorizing Commissioner Ward to draw plans and advertise for three electrically driven pumps for the new water-works system; two of 20,000,000-gal. capacity and one of 25,000,000 gal.

CHARLOTTE, N. Y.—The contract for the new cable towers to be erected on each side of the harbor at Charlotte has been awarded to the Seneca Engineering Company, of Montour Falls, N. Y The towers will be 167 ft. in height and are to be completed by May 20.

ELMIRA, N. Y.—Arrangements are being made by the Thatcher Manufacturing Company to install a new generator in the power plant of its agriculture implement factory.

GOUVERNEUR, N. Y.—Plans are being considered for the development of the South Edwards water power by wealthy mill owners and lumbermen of Gouverneur and Watertown. An option has been secured on the property. The power will probably be utilized to operate a large pulp and paper mill and the surplus transmitted to Harrisville, Edwards and other towns for lamps and motors.

NEW YORK, N. Y.—At a special meeting of the Great Eastern Telephone Company, held recently, the capital stock of the company was increased from $1,000,000 to $50,000,000.

NEW YORK, N. Y.—Bids will be received until April 19 by C. B. J. Snyder, superintendent school buildings, Department of Education, for installing electric equipment, in addition to and alterations, in Public School No. 87, on Washington Avenue, between Pulaski and Lafayette streets, Middle Village, Borough of Queens.

OGDENSBURG, N. Y.—The directors of the New York & Ontario Power Company have authorized the sale of $1,850,000 in bonds, the proceeds to be used for developing water power at Waddington, N. Y. The company owns all power rights between Waddington and Crapser's Island, which is estimated capable of developing 30,000 hp. It is proposed to replace the present dam with a concrete dam. The cost of the entire plant and equipment is estimated at $2,000,000. The company holds the right to sell electricity in both United States and Canada, and will furnish electrical energy to operate the new Norwood & St. Lawrence Railroad.

ONEIDA, N. Y.—Preparations are being made by the Madison County Gas & Electric Company for a general overhauling of its plant and lines, which will involve an expenditure of about $25,000.

PATCHOGUE, N. Y.—The Patchogue Electric Light Company has filed an amendment to its charter increasing its capital stock from $40,000 to $70,000. E. E. Hawkins is president of the company and H. S. Conklin, secretary.

RAYBROOK, N. Y.—Governor Hughes has signed the bill appropriating $307,300 for an additional pavilion, power house, new reservoir and other improvements at the State Hospital for the Treatment of Incipient Tuberculosis at Raybrook.

TALCVILLE, N. Y.—The board of directors of the Uniform Fibrous Talc Company has decided to build the new mills of the company on the Freeman farm, in Talcville, near the mines. A concrete dam will be built and a power house erected to generate electricity, which will be transmitted to the mills, about 1¼ miles distant. The entire plant will be operated by electricity, including the machinery at the mines. Connell & Connell, of New York, N. Y., are the architects. F. W. Sybel is president.

ELIZABETH CITY, N. C.—Arrangements are being made by the Elizabeth City & Albemarle Electric Railway Company for the construction of its proposed electric railway from Elizabeth City to Albemarle Sound, a distance of about 14 miles. D. G. Wilson, of Weeksville, N. C., is interested in the enterprise.

GOLDSBORO, N. C.—The Goldsboro Traction Company has nearly completed a 2½-mile street railway in Goldsboro. Plans are now being considered for the immediate extension of the railway to Swan Springs and White Hall, a distance of 16 miles. E. T. Oliver, of Raleigh, N. C., is president and general manager.

KING, N. C.—The Quickstep Telephone Company is making arrangements to improve and extend its service and will erect telephone lines from King to Danbury, Rural Hall and Donnaha.

MIDDLESEX, N. C.—Preparations are being made by W. W. Lannon to install an electric light plant in Middlesex. Power for operating the system will be obtained from the mill, two miles distant.

SALISBURY, N. C.—The Southern Power Company, of Charlotte, N. C., has completed plans to erect a large transformer station at Salisbury, at a cost of $50,000. For further information address F. D. Sampson.

THOMASVILLE, N. C.—The right-of-way into Thomasville has been secured by the Southern Power Company for transmission lines already built to Lexington, a short distance away. A transformer station will also be erected here.

WASHINGTON, N. C.—We are informed that the Washington Investment Company is making arrangements to commence work at once on its proposed electric street railway in Washington, which will extend to Suburban Park at Washington Heights. A power station and repair shop will be erected at Washington Heights. W. E. Jones is president and general manager.

FARGO, N. D.—It is reported that the City Council will employ an electrical engineer to prepare estimates of cost for a municipal electric light plant.

GRAND FORKS, N. D.—The Board of Regents of the North Dakota University has awarded the contract for the construction of the new power house to Melby & Standahl, of Grand Forks, and for the erection of the 125-ft. concrete smokestack to Alphons Custodis, of Chicago, Ill.

LANSFORD, N. D.—The Farmers' Telephone Company is planning to make extensions to its system, which will require the erection of about 30 miles of line.

BRIDGEPORT, OHIO.—The Village Council will receive bids until June 1 for street lighting for a term of 10 years. The village has a population of over 4000 inhabitants. For further information address R. T. Michener, village clerk.

CLEVELAND, OHIO.—The Cleveland Worsted Mills Company is reported to have awarded a contract to the Allis-Chalmers Company for a 1500-kw generating unit for its power plant.

CLEVELAND, OHIO.—The County Building Commission has decided to ask for bids for furnishing light, power and heat for the county court house on a five-year contract. The Cleveland Engineering Company is preparing plans for a power plant to cost $150,000. The commission is asking for bids, with a view to deciding whether it will be cheaper to purchase the service or install a plant in the county court house.

COLUMBUS, OHIO.—Arrangements have been completed by the Orr Felt & Blanket Company for the erection of a felt and blanket mill. The mill will be operated by electricity, which will be generated by the company's own plant.

COLUMBUS, OHIO.—Bids will be received by the Board of Public Service, City Hall, Columbus, Ohio, until April 21 for furnishing labor and materials for construction and erection of additional machinery at the municipal electric light plant as follows: Item 1—One high-pressure condensing steam turbine capable of driving a direct-connected generator with a rating of 2000 kw under normal load conditions; one 2000 kw alternator. Item 2—One 2000-kw surface condenser and accessories. Item 3—Additional switchboard in accordance with the specifications on file in the office of the Board of Public Service. Bidders may submit propositions on each of the above items separately, or any number thereof, or on the whole, but if on the whole, or more than one, the amounts bid on each item must be separate. Edward W. Hirsch is secretary.

NILES, OHIO.—The Board of Public Service is considering the question of abandoning the city plant and procuring electricity for operating the municipal electric system from the Hydro-Electric Company at Warren, Ohio.

PAINESVILLE, OHIO.—The City Council has decided to install additional equipment in the present municipal electric plant to enable the plant to furnish electricity for small manufacturing concerns until the new plant can be installed. The new equipment will include one direct-connected 250-kw generator, to cost $4,300; one 300-hp engine, $3,000; switchboard, $300; piping and feed-water heater, $1,000; foundations for engines, $500; one boiler set, $1,500; transformers and wire, $1,500, and addition to building, $1,100, making a total of $13,500. The city is also considering the question of operating the water-works pumps by electricity. W. N. Collister is superintendent of the municipal electric plant.

HOBART, OKLA.—The Oklahoma Midland Electric Railway Company would like to communicate with contractors with a view of awarding a contract for construction of three miles of track. H. H. Hoover is president.

SPIRO, OKLA.—Plans and estimates are being prepared for an electric light and water system in Spiro to cost about $40,000.

TISHOMINGO, OKLA.—It is understood that Dr. S. W. Skillern proposes to develop the water power of Pennington Creek Falls, which will be utilized to generate electricity to operate the proposed electric railway from Oklahoma City to Dallas, Tex.

COQUILLE, ORE.—The City Council has granted the Coquille Mill & Mercantile Company a franchise to construct and operate an electric light and power plant and electric railway in Coquille.

HOOD RIVER, ORE.—A 50-year light and power franchise has been granted to the Watt Development Company.

PORTLAND, ORE.—Plans of D. E. Keasey for the construction of an electric railway, with loops from Twenty-third and Washington streets to Parkside, have been approved by the County Court and County Commissioners. The proposed extension will cost about $20,000, and when finished it is understood that the line will be taken over by the Portland Railway, Light & Power Company.

ST. HELENS, ORE.—The St. Helens Lumber Company has awarded the contract for the construction of its power plant to the Northwest Bridge Company, of Portland, Ore.

CANONSBURG, PA.—The power plant of the Greek coal mine, owned by John M. Greek, was destroyed by fire April 8, causing a loss of about $13,000.

CANONSBURG, PA.—The Washington Electric Light & Power Company, of Washington, Pa., has purchased nearly all of the stock of the Canonsburg Electric Light, Heat & Power Company. The new owners contemplate improvements to the plant, which will be operated until the transmission line is extended from the plant in Washington. A 24-hour service will be established when connections have been made with the Washington plant.

CARLISLE, PA.—The contract for the construction of the Cumberland Electric Railway from Carlisle to Newville, a distance of 12 miles, has been awarded to the Carlisle Construction Company. The cost of the road is estimated at $300,000.

HAZLETON, PA.—Preparations are being made by Jeremiah Woodring & Company for the installation of a new electrical unit in their power plant, which is said to be the forerunner of important extensions to the plant.

LEBANON, PA.—The Ona & Lebanon Rural Telephone Company has applied for a charter. The directors are: H. D. Wengart, Anson Wentling, Christian Wengart, A. H. Hetrick, and others.

PITTSBURGH, PA.—The Wisconsin Engine Company, of Corliss, Wis., has secured the contract for two single and two cross-compound engines to be connected to Western Electric generators with a total rating of 2400 kw in the Oliver power plant at Pittsburgh.

WASHINGTON, PA.—Plans have been completed by the Wellsburg & Bethany Street Railway Company for the construction of its railway from Bethany to Avella, a distance of seven miles.

ANDERSON, S. C.—Contracts for additional machinery to be installed in the Gluck Mills, Anderson, have been awarded by Robert E. Ligon, president, to Howard & Bullough American Machine Company, Pawtucket, R. I., and for electrical power equipment to the General Electric Company, Schenectady, N. Y.

GAFFNEY, S. C.—The Gaffney Manufacturing Company is making extensive improvements to its mill, which will be equipped to be operated by electricity.

GREENVILLE, S. C.—Plans are being made by L. M. Hubbard for the construction of an electric railway from Greenville to Paris Mountain, a distance of about seven miles. The residents of Greenville have raised a bonus of $30,000. L. M. Hubbard, with associates from Chicago, Ill., will finance the project.

BRYAN, TEX.—It is reported that J. T. Maloney, mayor, has offered for himself and associates to construct an electric railway between Bryan and College for a bonus of $10,000. A committee has been appointed to raise the fund. G. S. Parker is chairman of the committee.

HOUSTON, TEX.—The Citizens' Telephone Company has been placed in the hands of a receiver on petition of H. E. Huntington, a bondholder. It is stated that the receivership is preliminary to a reorganization of the independent system in Texas.

MOUNT PLEASANT, TEX.—Plans are being made to form a stock company for the purpose of constructing an interurban electric railway between Mount Pleasant and Red Mineral Springs. J. V. Moore, W. H. Seay and R. F. Lindsay were appointed as a committee to solicit subscriptions.

SAN ANTONIO, TEX.—It is stated that the San Antonio Gas & Electric Company has purchased the first unit for its new steam power station, consisting of a 2000-kw, General Electric, horizontal steam turbine, and three 500-hp Stirling boilers. W. B. Tuttle is vice-president and general manager.

SNYDER, TEX.—R. F. Brumback has been granted a franchise to install an electric light and power plant in Snyder.

EUREKA, UTAH.—Plans are being made by the East Tintic Development Company to place its plant in operation. A pipe line is being laid and an electric plant with sufficient output to supply 50 lamps will be installed at once.

SALT LAKE CITY, UTAH.—The Utah Light & Railway Company has commenced work on the rebuilding of the State Street-Murray line, at an estimated cost of $40,00; when completed the Murray end of the line will be extended to Bingham Junction, a distance of 4½ miles, with a branch to Sandy, from a point about half way between Murray and Sandy.

MONTPELIER, VT.—The Consolidated Lighting Company has entered into a contract with the Selectmen of the town of Barre for furnishing electricity for lighting the town for the coming year. The contract includes the villages of South Barre, East Barre, Websterville and Graniteville, and will require 323 incandescent lamps besides the arc lamps.

EDINBURG, VA.—The Valley Builders' Supply Company is considering the question of installing an electric light plant in Edinburg. J. C. Hutcheson is president.

RICHMOND, VA.—Bids will be received at the office of the city electrician, City Hall, Richmond, Va., until April 27 for furnishing material and labor required for the construction and equipment of an electric light plant, including construction of dams, raceways, foundations and other concrete work, rock excavation, radial brick chimney, turbines, intake gates and gear, trash racks, electric generators, steam turbines, exciters, switchboards, regulators, electric wiring, boilers, steam and water piping, railways, pumps, condensers, lamps and other accessories. Plans, specifications, proposal forms and form of contract may be seen at the above office and at the office of E. W. Trafford, consulting engineer, Chamber of Commerce Building, Richmond, Va. Proposals must be made upon forms supplied by the city. E. D. Richardson is chairman of committee on electricity.

BELLEVUE, WASH.—Application has been made to the Board of County Commissioners by D. C. Conover and E. P. Moran for a franchise to construct an electric railway over a portion of the county roads between Bellevue, on the east shore of Lake Washington, and a point on the west shore of Lake Sammamish, a distance of about 6½ miles. A franchise is also asked for a branch line from Medina Landing on Lake Washington, a distance of two miles, and also a branch line 1½ miles long on the west line of the railway.

BELLINGHAM, WASH.—Preparations are being made by the Cascade Valley Railway Company for the construction of an electric power plant on the Skagit River, seven miles above Marblemount.

ENTAIT, WASH.—The capital stock of the Entait Power Company has been increased from $50,000 to $200,000. The company is building a large plant, dam, canal and power house on the Entait River. Contracts have been placed for a large share of the output of the proposed plant. The company also contemplates furnishing electricity in Wenatchee.

GENEVA, WASH.—The Whatcom County Railway & Light Company is extending its transmission lines from Bellingham to Geneva.

NORTH YAKIMA, WASH.—The Yakima Valley Transportation Company has applied for a franchise to construct an electric railway on the roads of the Fruitvale district, and if granted the company will construct two railways, each three miles in length.

OAKVILLE, WASH.—S. K. Bowes and S. A. Wells have applied for a franchise to furnish electricity for lamps and motors.

PROSSER, WASH.—The Prosser Power Company is contemplating the construction of an entire new generating plant, two miles east of Prosser. The plant will be equipped with two units of 500 hp each. The company has taken over the water works system and franchises and electric light and power department of the Prosser Falls Land & Power Company, also the machine shop operated in connection with the plants. Edwin F. Benson is president; John Chisholm, vice-president, and Harry C. Benson, secretary, of the company.

SEATTLE, WASH.—The City Council has passed an ordinance providing for a system of cluster lamps on Broad Street.

SEATTLE, WASH.—It is reported that the Seattle-Tacoma Power Company contemplates extensive improvements to the Snoqualmie Falls plant and will increase the output to 30,000 hp.

WASHOUGAL, WASH.—Plans are being made by Cottrell & Son for the construction of a dam on the Washougal River, which will develop 1,000 hp. The dam will be located about 2½ miles from Washougal and will furnish power to generate electricity, which will be transmitted to Washougal and Camas, where franchises have already been secured to operate electric systems.

HUNTINGTON, W. VA.—The Ohio Valley Electric Railway Company is reported to have secured from the Chesapeake & Ohio Railway Company 38 miles of abandoned road between Barbourville and St. Albans, and will also construct 20 miles of new railway to provide a route between Huntington and Charleston, W. Va. W. C. Sproul, of Chester, Pa., president of the Kanawha Valley Traction Company, is interested in the project.

GREEN BAY, WIS.—The C. Killman Company's new planing mill has been completed. The mill will be equipped for electric motor drive.

HARTFORD, WIS.—Plans are being made by the Allenton-Kohlsville Telephone Company to construct about 20 miles of new telephone line during this season and also to rebuild part of its old lines.

HARTFORD, WIS.—Preparations are being made by the Hartford Canning Company to double the output of its plant and install new machinery to be electrically driven.

LA CROSSE, WIS.—The proposition to issue bonds for the construction of a municipal electric light plant will be voted upon at the April election.

MADISON, WIS.—The Interstate Power Company is making arrangements to furnish electricity in the lead and zinc districts to operate the mines, and is now placing contracts to furnish power.

MILWAUKEE, WIS.—It is reported that the Kopmeier Motor Car Company is planning to install an electric generator and will equip its plant throughout for electric motor drive.

RICE LAKE, WIS.—The Rice Lake & Northwestern Telephone Company and the Barron County Telephone Company are planning to extend their telephone lines this spring to take in several smaller towns.

WAUTOMA, WIS.—The Neshkora Electric Light Company, of Neshkora, has submitted a proposition to furnish electricity in Wautoma.

LARAMIE, WYO.—The Southern Wyoming Power Company has commenced work on the construction of the new electric light plant.

LOVELL, WYO.—The Rocky Mountain Bell Telephone Company has decided to sell its 13-mile line connecting Lovell with its main system to the Colony Telephone Company. The new owners expect to install new exchanges in Lovell and Cowley and propose to connect with Garland, Ralston, Penrose and Powell.

WINNIPEG, MAN., CAN.—We have been advised that two contracts have been awarded recently in connection with the Winnipeg power development at Point du Bois. The contract for line insulators was awarded to the Locke Insulator Manufacturing Company, of Victor, N. Y.; to the

Stuart Machinery Company, a contract for machine-shop equipment, for $1,554. Work has commenced on clearing the right of way for the transmission line, which will be 75.5 miles in length.

OTTAWA, ONT., CAN.—The Ottawa Electric Railway Company is planning to construct extensions to its system during the coming summer, and will also rebuild several of its lines with heavier rails.

PORT ARTHUR, ONT., CAN.—Bids will be received by the Railway Commissioners for material required to complete the double track of the Port Arthur & Fort William Electric Railway to the Fort William boundary. About 20 miles of new track will be added to the railway during 1909. N. C. Pilcher, of Port Arthur, is general manager.

MONTREAL, QUE., CAN.—The Montreal & Southern Counties Railway Company, which proposes to construct an electric railway between McGill Street and several communities on the South Shore, it is said, will soon award contracts for electrical equipment for its proposed railway. Announcement has been made that work will soon commence on the construction of its substation and car barns at St. Lambert, Que.

MEXICO CITY, MEX.—The Veyan, Jean & Company are installing a large hydro-electric plant for the purpose of furnishing electricity in Mexico City. The company is building a canal from the Alameda River, from which power will be obtained to operate the plant.

QUERETARO, MEX.—The Compania Hydro-Electrica Queretana is planning to erect another dam on the San Juan River in the State of Queretaro to furnish additional power to operate its hydro-electric plant.

SALINAS, MEX.—The Compania Salinas de Mexico is equipping its large salt refining plant at Salinas, to be operated by electricity, which will be furnished from the plant of the Benito Juarez Mines Company.

SANTA ROSALIA, MEX.—The Compania Productora de Hielo y Electricidad is installing an electric light plant in Santa Rosalia.

New Industrial Companies.

THE AMERICAN STEAM APPLIANCE COMPANY, of Chicago, Ill., has been incorporated, with a capital stock of $5,000, by George S. Andres, M. K. Andres and Walter A. Weisner. The company proposes to manufacture machinery, engines and boilers.

THE DELTA ELECTRIC & MANUFACTURING COMPANY, of Chicago, Ill., has been chartered with a capital stock of $5,000 to manufacture screw-in grounding devices and other electrical appliances. The incorporators are: Weldell P. Slayton, Harry E. Kiester and Frank L. Belknap.

THE DUPLEX NON-ARCING TROLLEY COMPANY, of New York, N. Y., has been chartered, with a capital stock of $2,000,000, to manufacture electric trolleys and mechanical devices. The incorporators are Arthur Olney and Frederick J. Ryan, of Providence, R. I., and Walter R. Lee, of New York, N. Y.

THE ELLIOTT FURNACE APPLIANCE COMPANY, of New York, N. Y., has been chartered, with a capital stock of $100,000, for the purpose of manufacturing and installing machinery, boilers and fuel economizers. The incorporators are Thaddeus V. Elliott, William F. Marsh and Frank Martin, all of Brooklyn, N. Y.

THE ECONOMY LIGHT COMPANY, of Chicago, Ill., has been incorporated, with a capital stock of $100,000, by S. L. Shaeffer, W. V. Tyler, F. S. Abraham and S. J. Shaeffer, of Chicago, Ill. The company proposes to manufacture appliances for furnishing light and heat.

THE NATIONAL DICTOGRAPH COMPANY, of New York, N. Y., has been incorporated, with a capital stock of $1,000,000, by a syndicate which has purchased from the General Acoustic Company, 1265 Broadway, New York, N. Y., exclusive rights, to manufacture and sell the dictograph. K. M. Turner will be president of the new company.

THE STEPHENS ENGINEERING COMPANY, of Chicago, Ill., has been incorporated, with a capital stock of $50,000, to do a general engineering and contracting business, by Claude D. Stephens, Alton C. Stephan and Isaac Thompson, Jr.

THE TERNELLE ELECTRICAL COMPANY, of Portland, Maine, has been chartered for the purpose of dealing in all kinds of electrical apparatus. The company is capitalized at $200,000, and the officers are: Frederick P. Lewis, president, and Bion Bradbury, Jr., treasurer, both of Portland.

THE WESTCHESTER ELECTRIC SUPPLY COMPANY, of White Plains, N. Y., has been incorporated, with a capital stock of $2,500, by Irving W. Austin, of White Plains, N. Y.; Edward P. Barrett, Katonah, N. Y., and Rutherford B. Washburn, of White Plains, N. Y.

New Incorporations.

MONTGOMERY, ALA.—The Lewis Creek Railroad Company has been incorporated with a capital stock of $30,000 to construct a railway 40 miles in length, connecting Toinette and Skidder in Washington County. The incorporators are: S. R. R., H. W. and G. E. Cochrane, of Tuscaloosa, Ala.

FRESNO, CAL.—The Sierra Power Company has filed articles of incorporation for the purpose of developing the water power of the San Joaquin River, to be utilized to generate electricity. The company is capitalized at $100,000, and the incorporators are: C. K. Kirby, Jr., of Fowler; John W. McLaughlin, of Fresno; C. K. Kirby, Jr., of Fresno; F. W. Kirby, of Fowler, and D. C. McLaughlin, of Fresno.

RIVERSIDE, CAL.—The Corona Union Telephone & Telegraph Company, capitalized at $25,000, has been incorporated by J. G. Jameson, E. J. Genereaux, C. M. Scoville, G. E. Snidecor, W. L. Prizer, W. L. Peelerf and D. Lord, all of Corona.

SAN FRANCISCO, CAL.—The Smith River Electric Company, capitalized at $250,000, has been incorporated by D. C. Demarest, E. C. Hegler, S. Harris, C. M. Lindsay, W. P. Swart, A. V. Massey and Carl Senn.

SAN FRANCISCO, CAL.—The San Benito Light & Power Company has been incorporated, with a capital stock of $250,000 and the following directors: Charles W. Waller, Perry M. Reeves, of San Francisco; Thomas P. Pheby, Jr., of Oakland; H. H. Pitts, of San Mateo, and H. M. Wright, of Berkeley. The company proposes to generate and sell gas and electricity and to control a gas plant in Hollister.

CHICAGO, ILL.—The Oxford Junction Light, Power & Mill Company has been incorporated with a capital stock of $50,000 to operate a heat, light, power and milling plant. The incorporators are: W. C. Hill, A. Brothman, H. C. Smith and J. A. Swanson, all of Chicago, Ill.

HOLLAND, IND.—Party line No. 30, connected to the Holland Exchange, has filed articles of incorporation. Henry Welmeyer, Fred. Kuck, Christ. Ring and Fred. Satkamp are directors.

KOKOMO, IND.—The John R. Goyer Telephone Company has filed articles of incorporation. John R. Goyer, O. A. Clark and Joseph Hessler are directors.

WEBSTER CITY, IA.—The Air Line Telephone Company has been organized for the purpose of constructing telephone lines into Independence and Beliraburgs townships. Irving Lasher is secretary.

BANGOR, MAINE.—The Winooski Valley Power Company has been incorporated with a capital stock of $100,000 to generate and furnish electricity and gas, etc. The officers of the company are: J. Wilson, president, and L. B. Miller, treasurer, both of Bangor, Maine.

LINCOLNVILLE, MAINE.—Articles of incorporation have been filed for the Lincolnville Water Power Company, with a capital stock of $100,000. The company proposes to furnish electricity for lamps and motors in the towns of Lincolnville and Northport; also to engage in the manufacture of lumber and wood products. The officers are: E. H. Coleman, president, and J. P. Cilley, treasurer.

DETROIT, MICH.—The Leland Light & Power Company has been incorporated, with a capital stock of $30,000, by Charles S. and M. H. Abbott, of Detroit, and others.

KANSAS CITY, MO.—Articles of incorporation have been filed for the Blue Valley Traction Company by U. S. Epperson, J. M. Lowe, E. M. Sweetman, C. C. Carver and others. The company is capitalized at $300,000 and proposes to construct an electric railway from Raytown to Kansas City, a distance of 10 miles.

HELENA, MONT.—The Montana Rapid Transit Company has been incorporated with a capital stock of $5,000,000 for the purpose of constructing an electric railway from Helena to Butte, a distance of 72 miles. The officers are: Joseph K. Toole, president; H. G. Pickett, vice-president, and E. C. Day, secretary.

FULTON, N. Y.—Articles of incorporation have been filed for the Niagara-Oswego Power Company for the purpose of furnishing electricity for lamps and motors in Fulton. The company will have offices and a transformer station in this city, and in addition to furnishing electricity generated by Niagara power it will also purchase electrical energy developed by the Oswego River. The company will soon make application to the City Council for a franchise. The officers of the company are: S. B. Storer, of Syracuse, president; M. S. Powell, of Fulton, vice-president and general manager; E. M. White, of Phoenix, secretary and treasurer.

HENDERSONVILLE, N. C.—The Green River Power Company has been chartered with a capital stock of $100,000 by U. S. Staton, of Hendersonville; J. M. Torrence, of Waynesville, N. C., and W. A. Mauney, of Kings Mountain, N. C.

ATWATER, OHIO.—The Atwater Telephone Company has been organized, with a capital stock of $10,000, by H. S. Wilson and Frank Robison, of Palmyra; W. E. Craig, of Milton; S. W. Wilson, of Atwater, and H. L. Beatty, of Ravenna.

JOSEPH, ORE.—The Wallowa Lake Light & Power Company has been incorporated with a capital stock of $15,000 by J. H. Dobbin, Aaron Wade, L. B. Caviness, L. Knapper and Albert Warsweiler. The company has purchased a site for its power plant. Water will be piped from the lake, securing a fall of 147 ft., capable of developing about 3000 hp. The company proposes to supply Joseph, Enterprise and the ranches of Alder, Slope and Prairie Creek with electricity for lamps and motors.

PORTLAND, ORE.—Articles of incorporation have been filed for the Oregon Light & Power Company, with a capital stock of $2,000,000, by H. H. Riddell, A. McMurphey and N. L. Bailey. The company proposes to erect a hydro-electric plant on Eagle Creek in the Cascade Mountains and transmit electricity to Portland. The cost of the power plant, equipment and transmission lines is estimated at about $1,000,000.

TOPTON, PA.—The Inter-County Electric Railway Company has been incorporated, with a capital stock of $250,000, for the purpose of con-

structing a high-speed electric railway between Lyons and Allentown, a distance of 21 miles. The directors are: Maxwell H. Bochow, of Topton, president; George F. Souwers, Bateman Saddington, Joshua H. Fisher and Fred R. Perry.

HOUSTON, TEX.—The Brown-Woods Electric Company has filed articles of incorporation with a capital stock of $10,000. The incorporators are: D. Russell Brown, D. F. Woods, Russell Stapp and Frank C. Jones.

SOUTH ROYALTON, VT.—The South Royalton Power Company has filed articles of incorporation with the Secretary of State for the purpose of furnishing electricity in Royalton and South Royalton for lamps and motors and other purposes. The incorporators are: A. Curtis Fletcher, Ruth L. Howe and Robert B. Keltie, of Boston, Mass.; James G. Harvey, of White River Junction, and G. S. Edson, of West Lebanon.

CHARLES CITY, VA.—The Charles City Telephone Company has been incorporated and the following officers elected: H. S. Saunders, president; J. M. Bell, secretary, and L. M. Nance, treasurer.

CARP, ONT., CAN.—The Monk Rural Telephone Company has been organized with a capital stock of $30,000 and the following named officers: Robert Richardson, president; J. W. McElroy, vice-president; G. H. Groves, secretary and treasurer. The company will take over Monk rural telephone plant and will enlarge the system, making extensions to several towns, which will require the erection of 120 miles of wire.

Legal.

FALLEN ELECTRIC LIGHT WIRE AS EVIDENCE OF NEGLIGENCE.—In a recent action brought in Maryland to recover damages for an injury to a small boy received by coming in contact with an electric light wire while passing along a public avenue, it was held by the Court of Appeals of that State that the fact that the electric wire fell down into the street was sufficient evidence of negligence on the part of the company to allow the case to go to the jury. Walter vs. Baltimore Electric Company et. al, Court of Appeals of Md., 71 Atl. Rep., 953.

MOVING BUILDING UNDER ELECTRIC LIGHT WIRES.—The plaintiff in an action recently brought against an electric lighting company in New Hampshire was a carpenter, who had been injured by contact with one of the company's wires while assisting in the moving of a small house through the streets of Portsmouth. One of the men engaged on the work had telephoned to the superintendent of the street railway company and the latter sent a lineman, who worked for the street railway company as well as for the defendant, to take charge of the work of getting the building under the wires. It appeared that the wires were uninsulated and that the defendant had no license to place its wires across the street at the point where the accident occurred. The evidence also tended to show that the condition of the wires was dangerous, that the defendant was guilty of negligence in their construction and maintenance. Notwithstanding this, a verdict in favor of the plaintiff was set aside and a new trial ordered for the reason that it did not appear from the evidence that the superintendent of the street railway company had authority to direct the lineman to take charge of the work. Clough vs. Rickingham County Light & Power Company, Supreme Court of New Hampshire, 71 Atl., 223.

Personal.

MR. WILLIAM JENKS, of Woonsocket, R. I., has accepted the position as manager of the Bristol County Gas & Electric Company, at Bristol, R. I.

MR. D. B. RUSHMORE, of the General Electric Company, delivered a lecture April 2 before the Pittsfield A. I. E. E. Section on the application of electricity to steel mills.

MR. FRANK T. CLARKE, of the engineering department of the Commonwealth Edison Company, Chicago, has resigned to accept a position with the Pacific Gas & Electric Company, of San Francisco.

MR. T. E. DIBBINS, who has been manager of the supply department of the Pacific Coast office of the General Electric Company, has been promoted to be assistant Pacific Coast manager for that company, with headquarters at San Francisco.

HON, CHARLES ALGERNON PARSONS, inventor of the type of steam turbine that bears his name, is on a visit of 10 days to this country. He is accompanied by Mr. S. F. Prest, one of the directors of the Parsons Marine Turbine Company.

MR. A. J. FAULDER, formerly engineering assistant with the New York & New Jersey Telephone Company, has been appointed inspector of light and power in the Borough of Richmond under the Department of Water Supply, Gas and Electricity, New York City.

MR. GEORGE TAYLOR, for the past three years connected with the testing and construction department of the General Electric Company at Schenectady, has lately resigned to become a partner in the Taylor Machinery Company, 8 Oliver Street, Boston, Mass.

DR. RICHARD C. MACLAURIN, the new president of the Massachusetts Institute of Technology, will formally assume office June 7, with appropriate ceremonies, in Symphony Hall, Boston. A general reunion of the Institute graduates and many social events in the nature of celebrations are planned at this time.

MR. TURE N. STEEN, the Swedish electrical and mechanical engineer, who has been visiting this country for the past month, has returned home. His address in Stockholm is 4 Dalagatan, where he will be glad to receive inquiries and advices as to the introduction of electrical and mechanical inventions and appliances into Sweden. He is in command of capital for manufacturing purposes.

MR. FRANK N. BOYER, assistant manager of the Chicago office of the General Electric Company, who, accompanied by Mrs. Boyer, has been making an extended sojourn on the Pacific Coast and in the Hawaiian Islands for health and recreation, is on his way back to Chicago, where he is expected about May 1. Mr. Boyer's friends will be pleased to know that he reports that he never felt better in his life.

MR. WILLIAM A. BAEHR has opened an office as consulting engineer at 1943 Commercial National Bank Building, Chicago. Mr. Baehr was chief engineer of the Laclede Gas Light Company, of St. Louis, from 1903 to 1907. Before that he was with the Denver Gas & Electric Company, and he has built electric plants in Memphis, Tenn.; Beloit, Wis., and elsewhere. In addition to his engineering practice, Mr. Baehr will represent in Chicago Messrs. Bartlett, Hayward & Company, of Baltimore, Md.

MESSRS. L. B. MARKS AND J. E. WOODWELL, consulting engineers, Terminal Building, New York City, have just moved to larger offices in the same building. The firm and its associates cover broadly the field of mechanical, electrical and illuminating engineering and now have under way the preparation of plans and specifications for the equipment of a large number of buildings. The firm is also retained for special engineering services by several manufacturing companies in the electrical and illuminating line.

MR. FRANK F. KINNEY, acting head of the testing department of the Commonwealth Edison Company, Chicago, has resigned to become general manager of the Chicago Electric Meter Company, which manufactures, among other devices, a printing attachment for watt-hour meters invented by Mr. Kinney. During his service with the central-station company Mr. Kinney paid particular attention to the improvement of meters. Mr. E. O. Schweitzer has been appointed head of the testing department of the Commonwealth Company, with Mr. W. A. Durgin as first assistant.

MR. GEORGE W. WELLS, who for the past two years has been superintendent of the mechanical department of the West Penn properties, Connellsville, Pa., has resigned to represent the H. W. Johns-Manville Company as manager of its electrical department in New Orleans. Mr. Wells is a native of Boston and was for a number of years with the General Electric Company, having taken a shop course at its Lynn works and afterward having served in the engineering and sales departments. At a later date he became connected with the Stone & Webster Corporation and was manager of the electric lighting and street railway systems in Tampa, Fla.

Obituary.

MR. AARON K. STILES died from heart disease at his winter home, at Lajolla, Cal., on March 31. Twenty-five years ago Mr. Stiles was one of the conspicuous figures in the electrical manufacturing industry in the United States. His claim to distinction, in an electrical sense, rests chiefly on the fact that he had the foresight to recognize the great practical inventive ability of the late Mr. Chas. J. Van Depoele. Mr. Stiles financed Mr. Van Depoele, and thus played an important part in the introduction of electric lighting and electric railways in this country. Mr. Stiles was born in Canada, although of American parents, in 1834. He located in Chicago in 1849, and removed to Sycamore, De Kalb County, Ill., in 1852. He was county clerk of De Kalb County from 1853 to 1864, and was prominent in Republican politics. About 1873 he became interested in the barbed-wire fence business, owning half of the Kelley barbed-wire patents, under which the manufacture was carried on. In this business he realized a fortune. Becoming interested in the work of Van Depoele, Mr. Stiles assisted the inventor to form the Van Depoele Electric Light Company, in Chicago, about 1882. Subsequently Mr. Stiles became the president and principal owner of this company, and he pushed the electrical business with great vigor, for he was an ardent, energetic man. with much confidence in his own judgment. It is said that this company established the first electric arc lights in Chicago and was second only to the Brush Company in making such installations in the United States. As early as 1884 the Van Depoele Company used electric motors for driving machinery in its shop. Mr. Van Depoele was firmly convinced that the electric railway was practicable, and in 1883, backed by Mr. Stiles, he built the first trolley car. In 1884 the company was reorganized as the Van Depoele Electric Manufacturing Company, and it exhibited

A. K. STYLES.

an electric railway in operation at the Toronto Exposition of 1885. Here the underrunning trolley was used for the first time. Mr. Stiles maintained that the credit for this invention was his, the idea coming to him in passing a cooper shop that something like an oak barrel stave might be attached to the top of the car, maintaining contact with the overhead wire by pressing against it at the upper end of the stave. Mr. Van Depoele recognized the merit of the idea, and it is said that from this crude conception the underrunning trolley, practically as in use to-day, was developed by the great inventor whose name it bears. In 1888, when the Van Depoele patents were purchased by the Thomson-Houston Electric Company, the Van Depoele Company had equipped about 14 electric railways. At this time Mr. Stiles retired to Streator, Ill., and for 15 years he and his sons were owners of the Streator Gas & Light Company, selling out about two years ago. Thereafter Mr. Stiles invested largely in ranch lands in Montana. His wife died eight years ago, and he is survived by two sons and a daughter—William A. Stiles, Chicago; Everell D. Stiles, Miles City, Mont., and Mrs. John E. Brower, Grand Rapids, Mich.

MR. HERBERT D. SCRIBNER, Pacific Coast manager for the Allis-Chalmers Company, committed suicide in his offices in San Francisco on April 3. His act was brought on by severe and prolonged illness. Mr. Scribner was one of the best known and popular electrical men on the Pacific Coast. He went to the coast about 20 years ago at the age of 23 and was engaged in the construction of the first electric railway of that section, at Seattle. Afterward he was associated with Howard C. Holmes, of San Francisco, in building electrical lines at Stockton, Cal.; Tacoma, Wash; Vancouver, B. C., and between Oakland and Hayward, Cal. He was the San Francisco manager of the Westinghouse Electric & Manufacturing Company for many years, leaving that company to accept the management for the coast of the Allis-Chalmers Company. He leaves a widow and three children at his home in Alameda.

Trade Publications.

RECORDING GAGES for pressures and vacuums are described and listed in catalog No. 102 of the Bristol Company, Waterbury, Conn.

ENCLOSED FUSES of the refillable type are illustrated, listed and described in a booklet issued by the Crescent Company, 103 West Adams Street, Chicago, Ill.

SECTION SWITCHES.—The General Electric Company, Schenectady, N. Y., has issued bulletin No. 4654 devoted to section switches rated at 200, 400, 600 and 1200 amp.

PHOSPHOR BRONZE.—Price List No. 24 of the Phosphor Bronze Smelting Company, 2200 Washington Avenue, Philadelphia, deals with phosphor bronze alloys in ingots and castings, rods, wires, ropes, sheets and plates.

ELECTRIC HARDENING FURNACES.—Bulletin No. 4655 of the General Electric Company, Schenectady, N. Y., gives a detailed description of an electric furnace for use in connection with tempering and annealing.

FANS.—Catalog No. 70 of the Robbins & Myers Company, Springfield, Ohio, is an artistic publication, giving much information concerning "Standard" ceiling, desk, bracket oscillating and exhaust fans for both direct-current and alternating-current circuits.

MOTOR-STARTING DEVICES.—Pamphlet No. 3768, of the General Electric Company, Schenectady, N. Y., contains a comprehensive list of motor speed-controlling devices and both automatic and non-automatic starters. Each device is illustrated and briefly described.

TANTALUM LAMPS.—Booklet No. 3737 of the General Electric Company, Schenectady, N. Y., states the advantages to be derived from the use of tantalum lamps for the illumination of railroad cars, and contains a reference to the steam turbo-generator outfit designed for use in connection with the illuminating system on trains.

NERNST LAMP FIXTURES.—The Nernst Lamp Company, Pittsbugh, Pa., has issued an advance bulletin devoted to chandeliers and ornamental fixtures for Nernst lamps. A complete price list is given of all of the fixtures, many of which are of new design. Lamps for both direct-current and alternating-current circuits are listed.

INSULATION.—The John C. Dolph Company, 153 West Avenue, Long Island City, New York, has issued an American edition of its catalog on insulation specialties, which is also printed in French, German, Italian and Spanish. The specialties include varnish compounds for use with armature and field coils and dynamos and transformer core plates.

STEAM TURBINES.—The Kerr Turbine Company, Wellville, N. Y., has issued as Bulletin No. 8 a well-illustrated description of the Kerr steam turbine. This turbine utilizes the principle of the Pelton water wheel; it is of the multiple bucket and nozzle impulse type. Illustrations are given of turbines directly connected to generators, pumps and ventilating fans.

EXTENSION DIFFUSERS.—The General Electric Company, Schenectady, N. Y., in Folder No. 3761, entitled "Extension Diffusers," describes a diffuser for use in connection with incandescent lamps designed to meet the demand for an incandescent lamp fixture, embodying æsthetic as well as the scientific principles required for certain high-grade incandescent lighting. These diffusers are especially recommended for store lighting.

DIRECT-CURRENT MOTORS.—The Robbins & Myers Company, Springfield, Ohio, has issued as "Standard Motor Book" No. 75, an illustrated catalog covering its complete line of direct-current motors and generators and special types of motors. The regular line of motors range in rating from 0.033 hp to 15.0 hp, while special motors are built for all services to which motors can be put.

BELL-RINGING TRANSFORMERS.—In Folder No. 3765 the General Electric Company, Schenectady, N. Y., illustrates and describes a small transformer for use in connection with the operation of electric call bells. The idea in the use of the transformer is the elimination of the usual battery for this purpose and the utilizing of energy from the lighting circuit. The transformer will operate on voltages ranging from 100 to 130 at the usual lighting frequency.

CURTIS TURBINE GENERATOR.—A handsome publication devoted to the Curtis turbo-generator has recently been issued by the General Electric Company under the number 4653. This bulletin is elaborate as to details of construction, containing interior views and cross-sections of various parts of turbine and generator. It describes large and small turbines of vertical and horizontal types, and contains illustrations of numerous representative Curtis turbine installations.

Business Notes.

JOHN F. ZERBEY, JR., electrical constructor, has opened an office at Fourth and Arch Streets, Pottsville, Pa.

KATES & COMPANY.—Kates & Bok, exporters of machinery and supplies, 79 Wall Street, New York, have changed their firm name to Kates & Company.

MR. F. F. FOWLE, consulting electrical and telephone engineer, Chicago, has moved his office from Room 736, Marquette Building, to Room 937 in the same building.

THE BUCKEYE ENGINE COMPANY, Salem, Ohio, announces the appointment of Mr. Louis Bendit as Kansas City sales manager, and of Mr. J. R. Detweiler, district manager, Wichita, Kan.

NEW FLAME ARC LAMP.—The Excello Arc Lamp Co., New York, is introducing the new "Duplex" Excello arc lamp to the trade. This lamp has recently been the subject of favorable articles in foreign technical journals.

COPPER-CLAD STEEL WIRE.—The Duplex Metals Company, Philadelphia, has been informed that the only wire that stood up in the Northwest during the great sleet and wind storm of early March was its copper-clad steel wire.

THE INTERNATIONAL ELECTRICAL CORPORATION is preparing to open a factory in Portland, Maine, for the manufacture of storage batteries. The company states that it has the right to manufacture and sell in this country the Ternelle battery, an Italian invention, which has been in successful operation in Italy for a number of years.

MR. JOHN W. FREEMAN has been appointed manager of the Sprague Electric Company's Pittsburgh office to succeed Mr. F. W. Barry, who recently resigned. Mr. Freeman has been associated with the Pittsburgh office for some time and is fitted by training and experience to give efficient attention to the Sprague company's business in that territory.

DOSSERT & COMPANY, New York, report the receipt of large orders for solderless cable taps ranging in size from 6 to 500,000 circ. mils and for various types of lugs from the Buick Motor Company, Flint, Mich.; Edison Electric Illuminating Company, Brooklyn; General Electric Company; Southern Wisconsin Power Company; Electric Appliance Company, and E. C. Tibbals & Company, of Brooklyn.

MR. FRANK WELLS HALL has been appointed manager of the Philadelphia office of the Sprague Electric Company. Mr. Hall was formerly connected with the Sprague Electric Company, both in the New York and Chicago offices in engineering and sales capacities. His knowledge of the Sprague Electric products, combined with his wide circle of acquaintances and his extensive business and engineering experience, will undoubtedly win for him a large clientèle in his new territory. Mr. Hall assumes his new duties April 15, 1909.

FACTORY FLAMING-ARCS.—The Stave Electrical Company has recently received an order for approximately 100 Stave flaming-arc lamps from the Weston-Mott Automobile Company, of Flint, Mich. These lamps are being used throughout the different departments of the factory. The adoption of an installation of Stave flaming-arc lamps has resulted in all-around economy in operation and has made the Weston-Mott shops one of the best lighted in the country. The clear orange color and even distribution of the light have also increased the efficiency of the staff, and several other automobile concerns are now considering the installation of Stave flaming lamps.

THE DUNTLEY MANUFACTURING COMPANY, of 305 Dearborn Street, Chicago, Ill., incorporated under the laws of Delaware with a capital stock of $500,000, has announced its permanent organization. The company, which manufactures vacuum cleaners, gasoline-electric handcars and calculating machines, has been in operation sixty days, is operating a plant in Chicago and has four other factories at other points under contract. Mr. Duntley was formerly president of the Chicago Pneumatic Tool Company. The officers of the company are: J. W. Duntley, president; A. W. Maconochie, vice-president; F. A. Rautenberg, secretary, and Eugene McComas, treasurer.

Weekly Record of Electrical Patents

UNITED STATES PATENTS ISSUED APRIL 6, 1909.

[Conducted by Wm. F. Bissing, Patent Law, 2 Rector St., N. Y. City.]

916,994. ELECTRIC HEATER; G. W. Carpenter, J. Rasmussen and F. B. McCrosky, Ontario, Cal. App. filed April 16, 1908. An electric heater having a body portion with rounded grooves in its upper face and cores disposed in said grooves, the cores having flat upper faces and rounded surfaces, thus confining the heat near the bottom of the plate.

917,000. RHEOSTAT; L. S. Chapman, Schenectady, N. Y. App. filed June 24, 1909. A pair of circuit arms are yieldingly held together, the arms being moved together to a predetermined position and one arm continuing its movement, together with a latch which prevents the return of arm from the predetermined position until the other arm returns and trips the latch.

917,003. SEMAPHORE SIGNAL; A. G. Clark, Schenectady, N. Y. App. filed July 31, 1908. An electric motor semaphore signal in which a gear wheel drives the signal from the motor and in which the arm is locked to the gear wheel in one direction and unlocked when the gear wheel returns, thus preventing the signal from moving to danger to clear except when driven by the motor.

917,011. PRINTING TELEGRAPH; A. C. Crehore, Yonkers, N. Y. App. filed Jan. 16, 1905. A series of magnets at the receiving station are actuated by a typewriter at the sending station and operate the keys of the typewriter at the receiving station. Improvement on the prior system of the same patentee.

917,017. MAGNETIC DEVICE FOR TELEPHONE SYSTEMS; W. W. Dean, Chicago, Ill. App. filed Jan. 6, 1904. Common battery telephone system in which the number of individual apparatus and contacts are reduced to one set. The magnets of the heretofore separate relays are included in a single structure and provided with a single set of contacts.

917,018. ELECTRICAL APPARATUS AND METHOD OF MANUFACTURING AND OPERATING THE SAME; J. T. H. Dempster, Schenectady, N. Y. App. filed Aug. 23, 1904. A condenser is placed in a fluid insulating bath of oil under pressure which causes the air in the dielectric to be taken up by the oil.

917,023. MOTOR-CONTROLLING DEVICE; G. H. Dorgeloh, Schenectady, N. Y. App. filed June 24, 1908. A starting rheostat, an auxiliary resistance, an electromagnet connecting said resistance in parallel with the motor armature during a portion of the movement of the rheostat and excluding the auxiliary resistance during the remainder of the movement.

917,025. ELECTRIC SWITCH; W. Drake and L. C. Hatch, Black Earth, Wis. App. filed Jan. 21, 1907. Cut-outs for fuse boards for telephone switches comprising a plurality of contacts, a switch blade supported on links at each end and a handle for giving the blade a movement.

917,031. INSULATOR FOR HIGH TENSION TRANSMISSION LINES; C. E. Eveleth, Schenectady, N. Y. App. filed Sept. 3, 1908. For electric railways which employ a catenary system of suspension of the working conductor, to avoid breakage of insulators by wanton throwing of stones. Introduces breakage lines in the petticoat of the insulator so as to limit the breakage to the outer portions thereof.

917,040. ELECTRIC TRANSFORMER FURNACE; O. Frick, Saltsjobaden, Sweden. App. filed March 2, 1904. The mass to be heated is on an annular hearth and acted upon by induction from a primary coil.

917,041. CARBON FEEDING DEVICE FOR ARC LAMPS; R. Fritz, West Hoboken, N. J. App. filed Feb. 28, 1908. An electric arc lamp with an automatic intermittent feed of electrodes, including a star wheel engaging the carbon near the electrode, the carbon descending by gravity.

917,047. SECONDARY ELECTRIC CLOCK; P. G. Giroud, New York, N. Y. App. filed Nov. 15, 1907. For advancing the hands of a clock step by step and holding them in position against displacement. Details.

917,053. ELECTRIC HEATER; R. L. Hailey, New York, N. Y. App. filed June 11, 1908. A smoothing iron in which the bottom plate is heated electrically by means of a single layer of resistance wire. A thin sheet of insulation is interposed between the wire and the plate.

917,061. FIRE ALARM SIGNAL SYSTEM; B. B. Hatch, Boston, Mass. App. filed July 15, 1908. Means for automatically indicating that the battery or batteries are out of order, the system being a closed circuit one with an alarm bell so arranged that the failure of the battery, etc., gives an alarm.

917,064. VENTILATING SUPPORT FOR ARMATURE TEETH; T. Hibbard, Minneapolis, Minn. App. filed Nov. 17, 1905. The ventilating support is applied between the laminas composing the armature and the end plates and consists of a plurality of U-shaped pieces of metal or teeth.

917,069. CLAMPING EAR FOR TROLLEY WIRES; R. L. Hoffman, Schenectady, N. Y. App. filed Oct. 8, 1907. A clamping ear for suspending the trolley wire, comprising two jaws, each having an elevated shoulder at one side with means for forcing down the shoulders so as to clamp the wire, by turning a nut.

917,070. IMPELLING DEVICE FOR CIRCULATING SYSTEMS; E. P. Holly, Roxbury, Mass. App. filed March 22, 1904. For securing circulation of ammonia, etc., by means of a motor driven electrically. Makes use of a plurality of motors driving a screw to feed the liquid, and throws in one motor when the other stops.

917,095. SPONGE INDICATING AND ALARM DEVICE; F. Mersfelder, Sr., Canal Dover, Ohio. App. filed April 25, 1908. Gives an alarm when the baker's dough has risen the right amount.

917,099. ELECTRIC ARC LAMP; B. Monasch, Berlin, Germany. App. filed Feb. 20, 1908. Means for starting a lamp by heating the arcing point by means of an auxiliary arc.

917,103. WIRELESS TELEGRAPHY; J. Murgas, Wilkesbarre, Pa. App. filed Oct. 7, 1905. Produces different spark frequencies without using interrupters. Inserts inductance in the primary circuit of an oscillatory system by pressing a key.

917,104. MAGNETIC WAVE DETECTOR; J. Murgas, Wilkesbarre, Pa. App. filed Sept. 29, 1908. A stationary magnet and a coil of conducting magnetic material rotating in the field of the magnet, together with means for rotating the coil and for conducting oscillations through the coil, the oscillations being rendered manifest by an inductive apparatus.

917,130. METER; W. H. Pratt, Lynn, Mass. App. filed May 4, 1904. An integrating watt meter in which an electric motor drives the wheel and permanent magnets act as a brake. The field coil is a ribbon wound on edge and the armature is spherical.

917,137. ILLUMINATING DEVICE; C. A. Robinson, Sitton, Colo. App. filed June 20, 1908. Two hollow spheres carry cone-shaped reflectors, in each of which an electric light is secured. They are arranged one above the other on transverse axes and rotated.

917,138. MAGNETIC WEDGE; C. Robinson, Schenectady, N. Y. App. filed Jan. 8, 1907. For retaining wedges closing the slots in the armature, consisting of a bar composed of metal (steel) having an inner layer of non-magnetic material.

917,145. ELECTRICAL SIGN RECEPTACLE; F. J. Russell, New York, N. Y. App. filed Dec. 11, 1907. An electrical receptacle for signs, receiving the sockets of incandescent lamps. It is made in two pieces of telescopically and adjustably related members.

917,147. ARC LAMP; R. H. Read, Schenectady, N. Y. App. filed Aug. 23, 1906. Means for starting arc lamps with titanium electrodes, comprising a clutch for raising the upper electrode, a shunt around the arc and a circuit closer in the shunt adapted to be closed by the clutch when the upper electrode drops.

917,159. FILAMENT FOR ELECTRIC INCANDESCENT LAMPS; John Johannes Schilling, Halensee, Germany. App. filed Dec. 24, 1906. The process of producing a metallic filament for lamps which consist in mixing finely powdered metal and heating the mixture.

917,163. WIRE SUPPORT; J. F. Scott, Highland Park, Ill. App. filed Nov. 5, 1906. For supporting trolley wires in which a pair of depending hooks interlock with the span wire and an abutment engages the wire between the hooks and holds them in interlocked position.

917,176. METHOD OF RECOVERING METALS; W. O. Snelling, Pittsburgh, Pa. App. filed Sept. 18, 1908. For getting tin from cassiterite by arranging it in contact with an electrode in an electrolyte capable of liberating hydrogen and passing a current through it.

917,181. SINGLE-PHASE ALTERNATOR; C. P. Steinmetz, Schenectady, N. Y. App. filed June 10, 1907. A synchronous single-phase alternator having a polyphase armature winding and a single-phase external circuit connected to one phase of the winding and a reactive winding connected to another phase of the winding.

917,183. MOTOR-CONTROLLING DEVICE; J. P. Tarbox, Washington, D. C. App. filed June 30, 1908. A starting resistance, a controlling member therefor, a solenoid in circuit with the motor which shifts the member as the motor current varies, an operating member having a bias to starting position latched to the controlling member, a no-voltage magnet and means for unlatching the members and releasing the controlling member when the operating member engages the magnet.

917,187. ELECTRICAL MEASURING INSTRUMENT; E. Thomson, Swampscott, Mass. App. filed Nov. 13, 1908. Comprises a support on two coils suspended from the support together with means for supplying current to the coils and indicating means for showing the movement between the coils.

917,188. DYNAMO ELECTRIC MACHINE; L. A. Tirrill, Lynn, Mass. App. filed Nov. 19, 1904. An electric automobile motor with most of its parts of standard size, and having auxiliary heads secured to the ends of the annular field rings.

917,189. SYSTEM OF MOTOR CONTROL; J. F. Tritle, Schenectady, N. Y. App. filed July 1, 1908. For two or more locomotives driven by induction motors in parallel, which are started by switches and whose speed is controlled by liquid rheostats in the secondary circuits of the motors.

917,190. MOTOR-CONTROL SYSTEM; J. F. Tritle, Schenectady, N. Y. App. filed Nov. 14, 1908. Particularly for induction motors in which a plurality of motors drive a common load and in which the short-circuiting switches for the several motors are closed automatically in succession.

917,195. ELECTRIC OVEN; T. Van Aller, Schenectady, N. Y. App. filed May 28, 1906. For heating the air and for cooking. Provides a stove within the heater.

917,197. TRAMWAY POINT; E. Veevers and G. H. Butterworth, Liverpool, England. App. filed April 11, 1908. Closes the switch by means of an electromagnetic apparatus without compelling the driver to leave the car.

917,200. ELECTRODE FOR SEARCHLIGHTS; H. Viertel, Charlottenburg, Germany. App. filed Oct. 25, 1907. Arranges the electrodes so that they converge and the positive electrode is made oval or rectangular so as to form a flat burning surface instead of a crater, thus improving the distribution of light.

917,207. INSULATOR; A Weber, Jr., Schenectady, N. Y. App. filed July 21, 1905. An insulator in two parts, each part cylindrical. Details.

917,209. SWITCH FOR ELECTRIC CIRCUITS; E. B. Wedmore, Rugby, England. App. filed Oct. 16, 1906. Switch for controlling circuit of electrically measuring instruments, the switch having a low contact resistance, provides means for tightening the brushes into close relation with the contacts.

917,212. ENVELOPE FOR VAPOR ELECTRIC CONDUCTORS; E. Weintraub, Schenectady, N. Y. App. filed June 15, 1903. Provides an exhausted outer envelope. The tube-like chamber between the inner tube and the outer tube serves as a condensing chamber for mercury vapor.

917,214. RINGER FOR TELEPHONE SYSTEMS; K. Weman, Buffalo, N. Y. App. filed Feb. 6, 1908. For harmonic selective signaling in which the armature actuating the clapper is yieldingly supported at one end which avoids the motion of the armature, thereby avoiding the hum at the uncalled subscriber's phone.

917,222. MOTOR-CONTROL SYSTEM; H. E. White, Schenectady, N. Y. App. filed Aug. 17, 1906. For electrically propelled cars, wherein the current for the motors is furnished by a generator driven by an oil or gas engine. The control of the motors is semi-automatic.

917,223. BRUSH HOLDER; E. R. Whitney, Lynn, Mass. App. filed June 24, 1904. A helical spring presses the brush against the segments, and the brush-carrying member is prevented from moving into contact with the segments by a stop.

917,224. INDUCTION MOTOR; J. B. Wiard, Lynn, Mass. App. filed Feb. 20, 1906. An induction motor having a laminated motor body provided with tunnels with switch contacts within the tunnels, thus controlling the resistance of the motor winding. The switch is worked by a push button passing through the bearing of the shaft.

917,229. RECEPTACLE FOR INCANDESCENT LAMPS; H. C. Wirt, Schenectady, N. Y. App. filed Feb. 27, 1906. Sockets for incandescent lamps used for indicating the presence or absence of currents on switchboards. A fuse is arranged in the socket. Details.

917,235. AUTOMATIC FIRE ALARM BOX; H. Anderson, Haddonfield, N. J. App. filed Oct. 6, 1908. A motor, an alarm mechanism having two contact members and means operated by the motor during the operation of the alarm for separating the contacts and breaking the motor circuit, together with means for locking the contact member in disengaged position.

917,238. CANOPY INSULATOR; E. E. Bechtold, Chicago, Ill. App. filed July 19, 1907. A shell-like canopy insulator having an external annular bead and an insulating strip between the bead and canopy and the base.

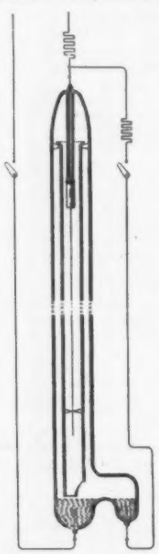
917,241. APPARATUS FOR ELECTRIC HEATING DEVICES; F. Boling, Frankfort-on-the-Main, Germany. App. filed Nov. 5, 1908. Improvement on 617,375. A mica strip is arranged in a suitable casing with a filler sheet metal surrounding the elements so as to increase the radiating capacity and thereby the load capacity.

917,263. TELEGRAPH REPEATER; C. E. Davies, Ottawa, Ont., Can. App. filed March 11, 1908. Reduces the number of instruments by making and breaking the main line by moving armatures which also make and break the local circuits.

917,272. DRY BATTERY; C. D. Enochs, La Crosse, Wis. App. filed May 26, 1906. A thin shell has an inner coat of water-proof material, the electrode being united with the shell. The carbon electrode is in the center of the shell as usual.

917,325. RECEPTACLE OR THE LIKE FOR CONDUITS; G. A. Lutz and C. C. Sibley, New York, N. Y. App. filed Oct. 26, 1905. For supporting rosettes having in combination a conduit provided with grooves and a base engaging the grooves of the conduit.

917,326. MEANS FOR HOLDING RECEPTACLES AND THE LIKE TO CONDUITS; G. A. Lutz, New York, N. Y. App. filed Feb. 23, 1907. Improvement on 834,839. A conduit has an open, trough-like mouth. The sockets can be adjustably secured to the trough. Details.



917,212.—Envelope for Vapor Electric Conductors.

917,500.—Undergrooved Trolley Wire.

917,327. BASE FOR SUPPORTING SWITCHES AND THE LIKE UPON CONDUITS; Mr. G. A. Lutz, New York, N. Y. App. filed Feb. 23, 1907. The conduit has an open, trough-like mouth and rotary switches can be secured to the conduit by means of screws. Details.

917,328. OUTLET OR JUNCTION BOX; G. A. Lutz, Plainfield, N. J. App. filed July 23, 1908. The conduit has a box operatively associated therewith and a cap having depending walls to overlap the box walls, the cap being provided with means to engage the walls of the conduit and retain it in position.

917,342. JUNCTION-BOX COUPLING; E. S. Morrell, Philadelphia, Pa. App. filed July 24, 1908. A coupling for attaching pipe conduits to junction boxes by means of a screw-threaded sleeve and nut, without threading the conduit pipe.

917,348. WALL SWITCH; W. J. Newton, Lynbrook, N. Y. App. filed July 21, 1908. Improvement on 702,989. Details.

917,367. MASSAGE INSTRUMENT; J. W. Scott and D. Tibbals, Granite City, N. Y. App. filed May 13, 1908. An induction coil in the handle supplies a shocking current to the massage roller.

917,372. MEANS FOR ATTACHING ELECTRIC LAMP SOCKETS; W. S. Stapley, Bridgeport, Conn. App. filed Oct. 1, 1908. A simple means for attaching sockets to the fixtures, the pipe being provided with a flange and screw threaded to receive the nut, between which nut and flange the cap of the lamp socket is secured.

917,396. CAR TROLLEY; A. Zaccaria and A. Belvedere, Uniontown, Pa. App. filed June 9, 1908. Prevents the trolley from jumping by providing arms which embrace the trolley wire. Details.

917,445. TROLLEY; A. S. Janin, New York, N. Y. App. filed Dec. 30, 1907. The trolley consists of a collapsible diamond-shaped frame operated by a spring and compressed air.

917,471. INDUCTION MOTOR; E. Mattman, Norwood, Ohio. App. filed March 17, 1906. Improvement in the means for securing the short-circuiting rings of squirrel-cage rotors in position.

917,500. UNDERGROOVED TROLLEY WIRE; Louis Steinberger, New York, N. Y. App. filed Nov. 23, 1903. The trolley wire has a longitudinal flexible member, the member being provided on opposite sides with webs which are wider than the body, so as to provide a contact face which is protected from the action of the weather and has a plurality of bearing surfaces.

917,501. THIRD-RAIL INSULATOR; L. Steinberger, New York, N. Y. App. filed June 5, 1907. The third-rail is mounted upon insulators having a metallic plate provided centrally with an opening, a bolt extending across the plate, a roller encircling the bolt, the roller engaging the rail and allowing play between the plate and the roller.

917,504. ELECTRIC HEATING APPARATUS; G. Teuber, Laasphe, Germany. App. filed Sept. 4, 1907. A flat spiral pancake-shaped heater of particular construction with a particular insulating paste.

917,510. DYNAMO-ELECTRIC MACHINE; A. H. Wouters, Norwood, Ohio. The rotor of a turbo alternator has its parts firmly held in place by means of bolts and wedges of special construction.

917,535. BRUSH HOLDER; A. J. Brown, Norwood, Ohio. App. filed July 30, 1906. Does away with the long, spiral spring in the brush holder by making use of a spring-pressed finger having at its free end a screw engaging the brush which may be adjusted to maintain the finger in the proper position for different lengths of brush.

917,541. ELECTRIC SWITCHING DEVICE FOR RAILWAYS; R. V. Cheatham, Louisville, Ky. App. filed June 25, 1907. A trolley pan having parallel flat strips with flat bottoms inclined at an angle to the horizontal and deflecting blocks over bars, which latter are attached to the pan.

917,542. SWITCH CONSTRUCTION; H. W. Cheney, Norwood, Ohio. App. filed Aug. 25, 1905. Reduces the sparking and provides means for adjusting the core of the tripping magnet. The switch operates by means of a toggle and links. Details.

917,548. COUPLING FOR ELECTRIC CONDUCTORS; A. H. Conway, Mason City, Ia. App. filed May 3, 1907. A two-part coupling detachably connected by screw threads and each having a drop of insulation carrying the contacts.

917,556. TROLLEY; C. A. Dean, Homestead, Pa. App. filed July 13, 1908. A trolley with means for preventing the wheel from jumping. Special construction of arms which embrace the trolley wire.

917,560. DRY-BATTERY CELL; W. S. Doe, Jersey City, N. J. App. filed May 11, 1908. A reservoir is made of zinc, sealed in the top of the battery and insulated from the carbon electrode, it being in contact with the enclosing electrode and containing an exciting fluid.

917,564. SWITCH; W. C. Dunn, Logansport, Ind. App. filed May 22, 1908. The switch is operated by a magnet, the circuit of which is controlled from the car.

917,574. DETECTING DEVICE FOR WIRELESS TELEGRAPHY; Reginald A. Fessenden, Brant Rock, Mass. App. filed March 26, 1907. The receiver comprises a conducting liquid and a conducting body projecting thereinto with means for supporting the body so as to balance it against the frictional stress of liquid, together with an indicator.

917,632. RAILWAY SIGNALING MEANS; R. J. Marshall, Newcastle-upon-Tyne, and W. H. Penman, Gateshead-upon-Tyne, England. App. filed April 18, 1908. For indicating to the driver of a train the condition of the various line signals, especially in foggy weather by actuating a signal in the cab. Details.

917,633. TELEPHONE TRANSMITTER; C. T. Mason, Sumter, S. C. App. filed April 27, 1908. A sound-receiving diaphragm removable and replaceable with a new one without changing the adjustment of other parts. The improvement is in telephone transmitters provided with a cell containing carbon particles.

917,700. RHEOSTAT; P. H. Zimmer, Schenectady, N. Y. App. filed Nov. 16, 1905. For use with small shunt-wound motors, in which both the starting and the regulating mechanisms are operated by a single handle, and a no-voltage release magnet holds the parts in running position.

917,703. ELECTRIC RAILWAY SIGNAL; W. J. Ashley, Denver, Col. App. filed May 11, 1908. Gives a signal when the rail is displaced by flood or fire, by closing an electric light circuit provided with lamps which show to the passengers on the train, as well as to the engine man, that the rail has shifted.

917,707. PROCESS OF MAKING CARBID OR CARBID-CONTAINING ELECTRODES; Henry S. Blackmore, Mount Vernon, N. Y. App. filed April 6, 1907. The process of making a composite carbid electrode, which consists in mixing the metal carbid with a solid hydrocarbon—carbon-yielding substance and exposing to heat.

917,714. TROLLEY POLE SUPPORTING AND CUSHIONING MEANS; S. C. Cooper and W. M. Austin, Johnstown, N. Y. App. filed May 3, 1907. A trolley-pole supporting and cushioning mechanism in which a spring and a pneumatic- or fluid-operated piston control the movement of the trolley wheel.

917,961. FIELD SPOOL FOR ELECTRIC MOTORS; E. H. Anderson, Schenectady, N. Y. App. filed Jan. 11, 1904. Prevents flashing at the commutator of direct-current motors by splitting the metal spools on which the insulated wires are wound for the field.

917,975. PULL SOCKET; J. R. Byrne, Schenectady, N. Y. App. filed Aug. 1, 1905. One pull turns on the lamp and the next turns it off. Provides a tumbler and spring construction and special design for the purpose.

917,981. PARALLEL OPERATION OF ROTARY CONVERTERS AND STORAGE BATTERIES; E. J. Berg, Schenectady, N. Y. App. filed Sept. 13, 1907. The rotary converter has a shunt and series winding and also an auxiliary field winding excited by a series-excited booster.

917,982. VOLTAGE REGULATOR; E. J. Berg, Schenectady, N. Y. App. filed May 12, 1908. Improvement in the well-known Tirrill volt regulator in which the exciter circuit, in addition to the regulator named, has an automatic booster set provided with a differentially wound motor which drives the booster generator.

917,983. REGULATING DEVICE FOR ALTERNATING-CURRENT CIRCUITS; S. R. Bergman, Lynn, Mass. App. filed June 14, 1905. In connection with the fixed primary and secondary windings, employs relatively movable primary and secondary windings in series with the first named and all in a common magnet circuit.

917,985. CONDUIT THREADING MACHINE; H. W. Boddy, Woodbury, N. J. App. filed Dec. 9, 1907. The conduit has a longitudinal passage and the machine has a smooth driving surface adapted to fit in between the diagonal corners of the conduit.

917,988. SYSTEM OF DISTRIBUTION; W. S. Bralley, Schenectady, N. Y. App. filed May 11, 1906. Sectionalized distribution system provided with automatic switches for connecting the sections together so as to utilize them in the most efficient manner.